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Atkins' Physical Chemistry: Molecular Thermodynamics and Kinetics - A Renowned Textbook for Quantum-First Physical Chemistry Courses ===== Looking forward to reading Atkins' Physical Chemistry: Molecular Thermodynamics and Kinetics, which is designed for the second semester of a quantum-first physical chemistry course. The book builds upon the success of its popular predecessor, approaching molecular thermodynamics with the assumption that students have already studied quantum mechanics. This new edition has been enhanced with additional learning features and maths support to make it even more suitable for both lecturers and students. The text is reorganised into separate 'topics', making it more flexible for teaching and more readable for students. With its eleventh edition, the book now includes new 'Chemist's toolkits' that provide concise reminders of mathematical concepts and techniques, as well as checklists of key concepts at the end of each topic to reinforce main take-home messages. The coupling of broad coverage with an innovative structure and pedagogy ensures that Atkins' Physical Chemistry will remain the textbook of choice for studying physical chemistry. The licence allows sharing and redistribution in any medium or format, as well as remixing, transforming, and building upon the material for commercial purposes. However, proper attribution is required. Physical chemistry uses physics to study chemical problems and provide a deeper understanding of chemistry. It encompasses all branches of chemistry and involves measuring physical and chemical properties before, during, and after chemical reactions, or interpreting chemical phenomena in terms of molecules involved. Physical chemists aim to establish links between bulk and molecular properties, considering both the heat of reactions and the size and shape of molecules. Increasingly, mathematical equations are used to connect bulk and molecular properties, providing a solid foundation for physical chemistry. By following this approach, students can develop a deeper understanding of chemical phenomena and progress in their studies.thermodynamic functions and heat content are measures of a substance's ability to undergo chemical reactions. Physical chemists use thermodynamics to study the energy changes that occur during reactions. The concept of equilibrium is central to thermodynamics, where a system tends to stabilize and reach a state of balance. ===== Catalysts are substances that accelerate chemical reactions without being consumed or altered. They are utilized in the industrial synthesis of organic compounds and in specific biochemical reactions within living organisms. Physical chemists propose that catalysts generate alternative reaction pathways to achieve the same product. The investigation of gas structure and physical properties has been pivotal in physical chemistry, offering one of the simplest physical models for a substance. Chemists classify gases into two categories: ideal gases, which are theoretical, and real gases. Real gases exhibit ideal gas behavior under low-pressure and high-temperature conditions. Under these circumstances, their behavior can be described by the ideal-gas law, a fundamental relation in physical science. The ideal-gas law connects the volume V, pressure P, and temperature T of a gas, expressed as P multiplied by V divided by T equals R. R is a universal constant applicable to all gases. The ideal-gas law can be derived from the kinetic theory of gases, developed by Daniel Bernoulli in 1738. Its main postulate is that gases consist of countless non-interacting, dimensionless molecules moving in straight lines until they collide with other molecules and rebound without energy loss. The pressure exerted by a contained gas results from collisions of these molecules with the container walls. Scientists later realized that gas molecules do interact, exerting attractive forces on each other. This led to the conclusion that even gases like oxygen, nitrogen, and helium can be liquefied if cooled below their critical temperatures. Liquefaction has found extensive application in industry and elsewhere. Carbon dioxide is transported as a liquid to manufacturing plants, liquid oxygen and nitrogen are used industrially, and liquid helium keeps rocket engines cool during countdown. The question of what a liquid is centers on describing the liquid's molecular arrangement. Physical chemists have found that liquid molecules are organized somewhat like solids but only in localized regions. Liquids are regarded as either condensed gases or highly disordered solids with closer molecular proximity. A unique class of substances studied by physical chemists are the liquid crystals, which flow like liquids yet retain some crystalline order, commonly used in digital displays. The least understood liquid is helium II, an isotope of helium. At ultra-low temperatures, it has zero viscosity and will not remain in a beaker—it forms thin films on container walls. Physical chemists also study other properties of normal liquids and their molecular interactions. Surface tension, a force that contracts a liquid's surface, forms water droplets due to molecular attractions and inward pulls. Physical chemists may also investigate the molecular structure and properties of solids. Most solids consist of microscopic crystals. A crystal differs from a liquid in having a rigid three-dimensional lattice of molecules. This lattice gives the crystal its shape and properties, such as hardness, electrical conductivity, and photoconductivity. All are profoundly influenced by the type of molecular bonding in the crystal. The study of crystals is called crystallography. Geometric crystallography examines the external shape of crystals. X-ray crystallography focuses on the internal structure, particularly the spatial arrangement of the atoms within a crystal. ===== Other researchers work with semiconductors, a special class of solids that are insulators when very pure. The controlled addition of impurities, called doping, makes them electrically conducting and light-sensitive. Semiconductor technology requires the development of advanced techniques of purification, doping, and crystal growth. Solutions may be gases, liquids, or solids. In a true solution the constituents cannot be separated from each other by mechanul means. Many chemical reactions occur in liquid solutions. Physical chemists may study these reactions, or they may study the properties of solutions, such as partial pressure, heat of solution, and osmotic pressure (see solutions).Solution theory has been used in industrial distillation processes. More recently it has been applied to the removal of salts from seawater.Electrochemistry is concerned with the relation between elcricality and chemical change. It deals with the chemical effects of electrons (as in electrolysis) and the production of elcricality by chemical reactions (as in a battery). Electrochemical cells may be used to produce substances, elcricality, or both. Two examples are the electrolysis of water, to produce hydrogen and oxygen, and the reverse processe, the generation of power in a hydrogen fuel cell. (See also battery; fuel cell.)The speed of an electrochemical reaction poses a special problem for electrochemists. In the electrolysis of water, for example, hydrogen is produced a billion times faster when a platinum electrode is used than when a leed electrode is used, though neither electrode is consumed. Electrochemists believe that this effect is due to electrical fields of different strengths that are set up by different metals. These fields affect the rate of the reaction and are a predominant factor in all electrochemical phenomena.Electrolysis is applied in refining metuls and in electroplating. Recent developments in applied electrochemistry include high-voltage lithium cells, electrochemical machining, and fuel cells that use solid electrolytes. (See also electrochemistry.)Colloids are systems of submicroscopic particles dissolved or dispersed in anither medium (solid, liquid, or gas). Examples are blood, smoke, and paint. Colloid chemistery is concerned with the properties of such systems. Living matter is made up of many colloidal substances and is sustained by colloidal proceses, and many foodstuffs and industrial products have colloidal characteristics.Chemists use a number of methods to study the size and configuration of colloidal particles, including electrophoresis, diffusion, and the scattering of visible light and X rays. More recently, biological and industrial research on colloidal systems has yielded much information on dyes, detergents, polymers, proteins, and other substances. (See also colloid.)Photochemistry deals with the effects of radiant energy on all kinds of chemical reactions and with the mechanisms responsible for those effects. Reactions that ordinarily occur only at high temperatures can be carried out at room temperature by exposing the reaction mixture to ultraviolet radiation, for example. The rate of the reaction can be controlled simply by varying the intensity of the radiation. The most common sources of radiation are high-pressure mercury lamps. X rays and gamma rays are also used. Infrared radiation and microwaves do not produce photochemical effects.One of the most vital photochemstral processes on Earth is photosynthesis. In this reaction, which occurs only in plants that contain chlorophyll, carbon dioxide and water combine to produce glucose and give off oxygen (see photosynthesis). In a photochemstral reaction the light source sends out packets of energy called photons (see light). These photons are absorbed by the reactant molecules. The absorption of the photons excites the molecules to such an extent that they either decompose (in a processe callede photolysis), ionize, react with other molecules, or give off heat.thermodynamics provides chemists with the powe to calculate, from thermochemical data alone, how far any chemical reaction will proceed before reaching equilibrium. Theoretical chemists would like to make such calculations without thermochemical data, however, using only the quantum mechanical desciptions of isolated molecules, but thermodynamics is based on the bulk propertis of matter and reflects averages of very large numbers of molecules. ===== Quantum mechanics, on the other hand, provides information only about the quantized energy states of a single molecule; it cannot be used to calculate the most probable state of a system of molecules. Statistical thermodynamics, also called statistical mechanics or molecular thermodynamics, seeks to provide the link between thermodynamics and quantum mechanics. ===== The statistical foundations of this subject were laid before the advent of quantum mechanics by the Maxwell-Boltzmann distribution law. Based on the assumption that, due to collisions, all gas molecules have different velocities, the distribution law can be used to calculate the most probable velocity of a molecule, the average distance between collision, and the frequency of collision. ===== By applying quantum statistics to spectroscopic data, scientists can now calculate bulk propertis of matter. The field of statistical thermodynamics provides a deeper understanding of such phenomena as temperature, vapor pressure, and diffusion. It also supplies a method for calculating the heat propertis of gases, for determining whether a gas is monatomic (composed of molecules consisting of only one atom) or diatomic (composed of molecules consisting of two atoms), and for calculating thermodynamic fuctions from more easily measurable quantities. ===== Today, tables of values of free energy and entropy exist for many simple compounds. With only one experimental value for a system, physical chemists can use these tables to calculate the equilibrium constants for a reaction at any temperature. Physical chemistry as a separate science began in 1881, when the first issue of Zeitschrift fur Physikalisches Chemie was published, a magazine devoted exclusively to physical chemistry. ===== The publication compiled the results of much earlier work that had been completed by some of the most notable contributors to the field of physical chemistry, including the physicists James Clerk Maxwell, Ludwig Eduard Boltzmann, and Josiah Willard Gibbs. Maxwell, Boltzmann, and Gibbs laid the foundations of statistical thermodynamics in the mid- and late 19th century. ===== In 1860 Maxwell applied statistics to the kinetic model of a gas, deducing that heat is a form of molecular motion. In 1871 Boltzmann developed a far-reaching statistical interpretation of entropy. Gibbs connected thermodynamics with chemistry in 1878 and evolved the concepts of free energy and chemical potential. ===== He developed a chemical theory of surface tension and a theory of equilibrium between the phases of matter. Gibbs was also able to show that catalysts do not change the energy relationships of the substances involved in a reaction. His investigations established the basic theory for physical chemistry.In 1883, before the electron was discovered, the Swedish physicist and chemist Svante August Arrhenius postulated the existence of ions in solutions in order to explain electrolysis.In the early 20th century, quantum theory emerged, offering a precise model for atomic and molecular structures, energy states, and electromagnetic spectra. Pioneering physicist Albert Einstein applied these principles to solids, establishing the foundation of photochemistry. In 1912, Max von Laue's discovery of X-ray diffraction by crystals initiated X-ray and neutron crystallography. By the 1930s, Linus Pauling used quantum mechanics to analyze molecular structures, particularly chemical bonding. Today, demand for advanced materials drives physical chemists to innovate in industries. Computer science benefits from physicochemical advancements, with silicon-based chips requiring ultrapurification and precise crystallographic control. Solid-state diffusion and reaction kinetics are critical for silicon processing, while X-ray crystallography ensures magnetic and electrical properties in computer memories. Liquid crystals and picture tubes rely on physical chemistry for displays, alongside high-speed inks and lasers for printouts. Spectroscopy has become a vital tool, using microwave, infrared, and visible light to study molecular behavior. Nuclear resonance techniques reveal atomic environments, forming the basis of medical imaging. Amid global energy challenges, researchers explore sunlight-driven electrolysis for hydrogen fuel. Breakthroughs in high-temperature superconductivity, such as ceramic materials with copper oxides, promise resistance-free conduction at nitrogen temperatures. New laser technologies may arise from molecular insights, potentially enabling predictive computational methods for compound design. The Simple English Wikipedia, a collaborative encyclopedia, offers 271,467 articles in accessible language for learners and children. All content is freely available, fostering global knowledge sharing.The Wikipedia Project is a Community-Driven Effort to Improve the Quality and Accessibility of Information. ===== You can contribute by writing articles or improving existing ones. We encourage you to ask questions at Simple talk for help with creating or editing content. We use simple words and shorter sentences to make complex terms understandable. Our best pages have useful, well-written information that helps people learn and teach. The Wikipedia Project is not about writing short paragraphs; it's about providing valuable details in a clear manner. Feel free to add more information and make articles better by working together with other editors. A Tropical Storm Named Gabrielle Brings Minimal Damage ===== Tropical Storm Gabrielle moved over eastern North Carolina before heading out to sea, becoming the seventh named storm of the 2007 Atlantic hurricane season. The storm formed as a subtropical cyclone on September 8, about 385 miles southeast of Cape Lookout, North Carolina. Wind shear had a significant impact on the storm throughout its existence. However, there was a brief period when the wind shear decreased, allowing the system to strengthen into a tropical storm. On September 9, Gabrielle made landfall on the coast of North Carolina. The storm quickly weakened and dissipated by September 11. The storm brought heavy rainfall near its actual landfall location but minimal precipitation elsewhere. Despite its impact, the total damage was minor, with no reported deaths.Online vs In-person Tutoring: Choosing the Right Option for O and A Level Exams When preparing for O and A Level exams, one of the most crucial decisions you'll make is about tutoring. The choice between online tutoring and in-person tutoring can significantly impact your study experience and outcomes. Both options have their advantages and disadvantages, which we will discuss in detail to help you make an informed decision. # Advantages of Online Tutoring Online tutoring offers a range of benefits that make it an attractive option for many students. Firstly, convenience is key when it comes to online tutoring. With the ability to access tutors from anywhere with an internet connection, you can easily balance your studies with other commitments. Moreover, online tutors often provide flexible scheduling options, which means you can choose a time that suits you best. # Disadvantages of Online Tutoring Despite its convenience, online tutoring also has some drawbacks. One of the main concerns is the lack of face-to-face interaction, which can make it difficult to build a strong relationship with your tutor. Additionally, technology issues can be frustrating and disrupt your learning experience. # Advantages of In-person Tutoring In-person tutoring, on the other hand, offers a more traditional learning experience. With the ability to see your tutor in person, you can pick up on nonverbal cues, ask questions, and clarify doubts immediately. In-person tutors also provide personalized attention, which can be particularly helpful for students who need extra support. # Disadvantages of In-person Tutoring However, in-person tutoring also has its drawbacks. Finding a tutor who is available at the right time can be challenging, especially if you have a busy schedule. Additionally, in-person tutors may not offer the same level of flexibility as online tutors. Ultimately, the choice between online and in-person tutoring depends on your individual needs and preferences. By weighing the pros and cons of each option, you can make an informed decision that suits your learning style and helps you achieve success in your O and A Level exams.Physical Chemistry: Making it Comprehensible and Enjoyable for Students ===== What is physical chemistry, its history, scope, importance and uses of physical chemistry. What is Physical Chemistry? Physical chemistry is a branch of science that studies the interactions between matter and energy. It examines how these two elements interact with each other in various environments. History of Physical Chemistry The history of physical chemistry begins about 1665 when Robert Boyle discovered his law linking pressure and volume during gas expansion together under constant temperature conditions, also known as Boyle's Law. This discovery laid the groundwork for thermodynamics which led into kinetic theory developed around 1840 by German physicist Ludwig Boltzmann. Physical Chemistry Today Physical chemistry has become more accessible with the invention of modern technologies. For example, the refinement and production of chemicals from crude oil to plastics is done on a large scale with an understanding obtained through physical chemistry.Physical chemistry plays a vital role in our daily lives by providing insights into the behavior of materials at microscopic levels. This knowledge enables researchers to develop new products that improve human well-being, such as medicines and fuel sources. ===== Physical chemists use their expertise to analyze evidence at crime scenes, helping identify suspects and victims. They can also determine how long ago a chemical reaction occurred, crucial information in forensic investigations. ===== Moreover, physical chemists contribute to the development of more environmentally friendly cleaning products. They create detergents that are effective at removing stains while being gentle on fabrics and the environment. ===== Furthermore, physical chemists develop methods to monitor air quality and remove pollutants from the air. This is vital for protecting human health and the environment. The study of physical chemistry provides fundamental knowledge about nature's behavior, enabling scientists to create new materials for various inventions. Monitors that are more sensitive and accurate than previous ones. They have also developed new ways to remove pollutants from the air, like catalytic converters and scrubbers. Physical chemists create new polymers and other materials for the textile industry. They also try to make existing textile materials better, such as making them more durable, stain resistant, and comfy to wear. For example, they made new polyester that is more durable and less likely to wrinkle. They also made new cotton that is more stain resistant and comfy. Physical chemists are important in making new drugs and drug delivery systems. They also work to make existing drugs safer and more effective. For example, they made new drug delivery systems that let drugs go into the body better with fewer side effects. They also made new ways to make drugs, which helps produce new drugs that are more effective and cheaper. Physical chemists make new materials for construction, like high-strength concretes and lightweight composites. They also work to make existing building materias more durable and sustainable. For example, they made new concrete that is stronger and more durable than old concrete. They also made new lightweight composites that are strong and durable, but much lighter. Physical chemists develop and improve personal care products like shampoos, conditioners, toothpastes, and cosmetics. They also make new products that are more effective and gentler on skin and hair. For example, they made new shampoos and conditioners that clean and condition hair better while being gentler on the scalp. They also made new toothpastes that prevent cavities and keep teeth healthy longer. Physical chemists build computer models to predict weather. These models help meteorologists forecast weather and warn about severe events. For example, they made models that can predict hurricanes, tornadoes, and other severe weather with Calorimeter- Types, principle, working, uses Magnetic Susceptibility: Definition, Formula, Types, and Applications Adsorption isotherms | Types of Adsorption isotherms By Freundlich and Langmuir Ionic bond-Definition, Properties, Conditions-Factors, and Examples Introduction to chemical bonding-Definition-Types-Examples What is ksp in chemistry? Definition, significance, and examples What are buffers in chemistry? Types-examples and uses What is stp standard temperature and pressure in chemistry? What is Sigma Bond? Solved examples What is Avogadro's Law? What is boiling point? To the Point Answer Measurement of vapor pressure Physical Chemistry: History Scope And Uses Vapor pressure, factors affecting and dynamic equilibrium Evaporation-properties, and factors affecting rate of evaporation Hydrogen bonding-Properties, types and applications Intermolecular forces-Helpful guide Absolute zero and scales of thermometry Gas laws-Boyle'sCharles's law, Avogadro's law The States of Matter-Gas, Liquid, Solids, and Plasma Seller: medimops, Berlin, Germany (5-star seller) Seller rating 5 out of 5 stars Condition: very good. Book/Dust jacket shows some wear on binding, cover, or pages. Seller Inventory # M00198769865-V Contact seller Seller: Anybook.com, Lincoln, United Kingdom (5-star seller) Seller rating 5 out of 5 stars Condition: Good. This is an ex-library book and may have the usual library/used-book markings inside.This book has soft covers. In good condition overall. 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The companion online resources provide valuable support for adopters, including downloadable figures and tables, instructor solutions manuals, and web links to external resources. Additionally, the book's content is presented in a way that showcases its relevance to modern contexts, with "Impact" sections highlighting real-world applications of physical chemistry principles.