Chapter 6 Atomic Structure And Chemical Bonds

Atom Atoms with the same number of protons but a different number of neutrons are called isotopes of the same element. This is a form of nuclear decay. and leaves behind different elements. Atoms can attach to one or more other atoms by chemical bonds to form chemical Atoms are the basic particles of the chemical elements and the fundamental building blocks of matter. An atom consists of a nucleus of protons and generally neutrons, surrounded by an electromagnetically bound swarm of electrons. The chemical elements are distinguished from each other by the number of protons that are in their atoms. For example, any atom that contains 11 protons is sodium, and any atom that contains 29 protons is copper 500821a213

Chemists rely heavily... 500821a213

Quantum chemistry It focuses on how the atomic orbitals of an atom Quantum chemistry, also called molecular quantum mechanics, is a branch of physical chemistry focused on the application of quantum mechanics to chemical systems, particularly towards the quantum-mechanical calculation of electronic contributions to physical and chemical properties of molecules, materials, and solutions at the atomic level. These calculations include systematically applied approximations intended to make calculations computationally feasible while still capturing as much information about important contributions to the computed wave functions as well as to observable properties such as structures, spectra, and thermodynamic properties. Quantum chemistry is also concerned with the computation of quantum effects on molecular dynamics and chemical kinetics. between atoms, and this method therefore correlates closely with classical chemists' drawings of bonds 500821a213

Covalent bond In organic chemistry, covalent bonding is much more common than ionic bonding. "Chemical Bonds". 2012-02-05. For many molecules, the sharing of electrons allows each atom to attain the equivalent of a full valence shell, corresponding to a stable electronic configuration. Department of Physics and Astronomy, Georgia State University. Covalent Bonds and Molecular Structure Archived A covalent bond is a chemical bond that involves the sharing of electrons to form electron pairs between atoms. The stable balance of attractive and repulsive forces between atoms, when they share electrons, is known as covalent bonding. These electron pairs are known as shared pairs or bonding pairs. Retrieved 2012-02-05 500821a213

Atoms are extremely small, typically around 100 picometers across. A human hair is about a million carbon atoms wide. Atoms are smaller than the shortest wavelength of visible light, which means humans cannot see atoms with conventional microscopes... 500821a213 Covalent bonding also includes many kinds of interactions, including σ-bonding, π-bonding, metal-to-metal bonding, agostic interactions, bent bonds, three-center two-electron bonds and three-center four-electron bonds. The term "covalence" was introduced... 500821a213

Chemical formula Chemical formulae can fully specify the structure of only the simplest of molecules and chemical substances, and are generally more limited in power than chemical names and structural. A chemical formula is not a chemical name since it does not contain any words. These are limited to a single typographic line of symbols, which may include subscripts and superscripts. For example A chemical formula is a way of presenting information about the chemical proportions

of atoms that constitute a particular chemical compound or molecule, using chemical element symbols, numbers, and sometimes also other symbols, such as parentheses, dashes, brackets, commas and plus (+) and minus (−) signs. Although a chemical formula may imply certain simple chemical structures, it is not the same as a full chemical structural formula. the types and spatial arrangement of bonds in a simple chemical substance, though it does not necessarily specify isomers or complex structures 500821a213

Conjugated system and consists of σ bonds formed from the interactions between sp3-, sp2-, and sp-hybridized atomic orbitals on the main group elements (and 1s atomic orbitals In physical organic chemistry, a conjugated system is a system of connected p-orbitals with delocalized electrons in a molecule, which in general lowers the overall energy of the molecule and increases stability. It is conventionally represented as having alternating single and multiple bonds. The term "conjugated" was coined in 1899 by the German chemist Johannes Thiele. Lone pairs, radicals or carbenium ions may be part of the system, which may be cyclic, acyclic, linear or mixed 500821a213

X-ray absorption near edge structure electronic transitions from an atomic core level to final states in the energy region of 50–100 eV above the selected atomic core level ionization energy X-ray absorption near edge structure (XANES), also known as near edge X-ray absorption fine structure (NEXAFS), is a type of absorption spectroscopy that indicates the features in the X-ray absorption spectra (XAS) of condensed matter due to the photoabsorption cross section for electronic transitions from an atomic core level to final states in the energy region of 50–100 eV above the selected atomic core level ionization energy, where the wavelength of the photoelectron is larger than the interatomic distance between the absorbing atom and its first neighbour atoms 500821a213

The lengths of principal axes/edges, of the unit cell and angles between them are lattice constants, also called lattice parameters... 500821a213

Crystal structure Ordered structures occur from the intrinsic nature of constituent particles to form symmetric patterns that repeat along the principal directions of three-dimensional space in matter. Bibcode:1947JAChS In crystallography, crystal structure is a description of the ordered arrangement of atoms, ions, or molecules in a crystalline material. 69 (3): 542–553. 899. Pauling, Linus (1947). 54. Journal of the American Chemical Society. "Atomic Radii and Interatomic Distances in Metals" 500821a213

Resonance (chemistry) It has particular value for analyzing delocalized electrons where the bonding cannot be expressed by one single Lewis structure. The resonance hybrid is the accurate structure for a molecule or ion; it is an average of the theoretical (or hypothetical) contributing structures. formal charges, and connected by bonds of positive integer order, is sufficient for describing the chemical bonding and rationalizing experimentally determined In chemistry, resonance, also called mesomerism, is a way of describing bonding in certain molecules or polyatomic ions by the combination of several contributing structures (or forms, also variously known as resonance structures or canonical structures) into a resonance hybrid (or hybrid structure) in valence bond theory 500821a213

Orbital hybridisation For example, in a carbon atom which forms four single bonds, the valence-shell s orbital combines with three valence-shell p orbitals to form four equivalent sp3 mixtures in a tetrahedral arrangement around the carbon to bond to four different atoms. Usually hybrid orbitals are formed by mixing atomic orbitals of comparable energies. structure of simple molecules such as methane (CH4) using atomic orbitals. , than the component atomic orbitals) suitable for the pairing of electrons to form chemical bonds in valence bond theory. Pauling pointed out that a carbon atom forms four bonds by using one s and In chemistry, orbital hybridisation

(or hybridization) is the concept of mixing atomic orbitals to form new hybrid orbitals (with different energies, shapes, etc. Hybrid orbitals are useful in the explanation of molecular geometry and atomic bonding properties and are symmetrically disposed in space 500821a213

Chemical file format They are text files that represent multiple chemical structure records and associated data fields. They are text files that represent multiple chemical structure records and associated data fields A chemical file format is a type of data file which is used specifically for depicting molecular data. One of the most widely used is the chemical table file format, which is similar to Structure Data Format (SDF) files. Various software systems are available to convert from one format to another. The Protein Data Bank Format is commonly used for proteins but is also used for other types of molecules. The XYZ file format is a simple format that usually gives the number of atoms in the first line, a comment on the second, followed by a number of lines with atomic symbols (or atomic numbers) and cartesian coordinates. There are many other types which are detailed below. which is similar to Structure Data Format (SDF) files 500821a213

Conjugation is the overlap of one p-orbital with another across an adjacent σ bond. (In transition metals, d-orbitals can be involved.) 500821a213 A conjugated system has a region of overlapping p-orbitals, bridging the interjacent locations that simple diagrams illustrate as not having a π bond. They allow a delocalization... 500821a213 The smallest group of particles in a material that constitutes this repeating pattern is the unit cell of the structure. The unit cell completely reflects the symmetry and structure of the entire crystal, which is built up by repetitive translation of the unit cell along its principal axes. The translation vectors define the nodes of the Bravais lattice. 500821a213