Crystal (H.1)

20170311

Molecule

A **molecule** is an electrically neutral group of two or more atoms held together by chemical bonds.[4][5][6][7][8] Molecules are distinguished from ions by their lack of electrical charge. However, in quantum physics, organic chemistry, and biochemistry, the term *molecule* is often used less strictly, also being applied to polyatomic ions.

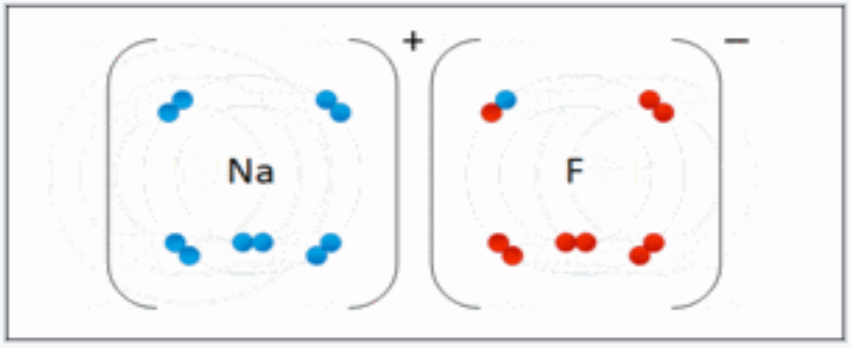
In the kinetic theory of gases, the term *molecule* is often used for any gaseous particle regardless of its composition. According to this definition, noble gas atoms are considered molecules as they are in fact monoatomic molecules.[9]

Chemical Bonds

A **chemical bond** is a lasting attraction between atoms that enables the formation of chemical compounds. The bond may result from the electrostatic force of attraction between atoms with opposite charges, or through the sharing of electrons as in the covalent bonds. The strength of chemical bonds varies considerably; there are "strong bonds" or "primary bond" such as metallic, covalent or ionic bonds and "weak bonds" or "secondary bond" such as Dipole-dipole interaction, the London dispersion force and hydrogen bonding.

Ionic Bonding

Ionic bonding is a type of chemical bond that involves the electrostatic attraction between oppositely charged ions, and is the primary interaction occurring in ionic compounds. The ions are atoms that have gained one or more electrons (known as anions, which are negatively charged) and atoms that have lost one or more electrons (known as cations, which are positively charged). This transfer of electrons is known as **electrovalence** in contrast to covalence. In the simplest case, the cation is a metal atom and the anion is a nonmetal atom, but these ions can be of a more complex nature, e.g. molecular ions like NH_4^+ or SO_4^{2-}. In simpler words, an ionic bond is the transfer of electrons from a metal to a non-metal in order for both atoms to obtain a full valence shell.



Sodium and fluorine undergoing a redox reaction to form sodium fluoride. Sodium loses its outer electron to give it a stable electron configuration, and this electron enters the fluorine atom exothermically. The oppositely charged ions – typically a great many of them – are then attracted to each other to form a solid.

Ion

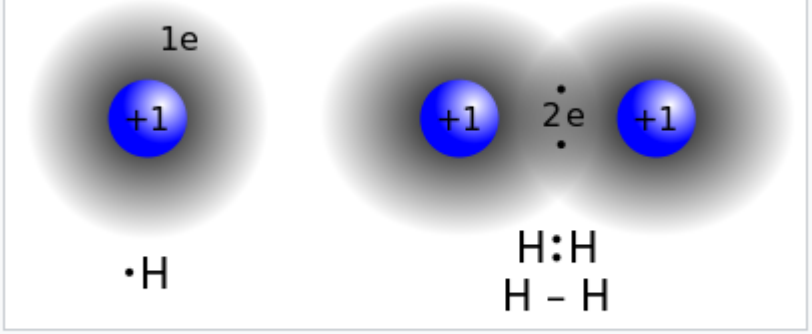
An **ion** (/ˈaɪən, -ɒn/)[1] is an atom or a molecule in which the total number of electrons is not equal to the total number of protons, giving the atom or molecule a net positive or negative electrical charge. Ions can be created, by either chemical or physical means, via ionization.

In chemical terms, if a neutral atom loses one or more electrons, it has a net positive charge and is known as a cation.

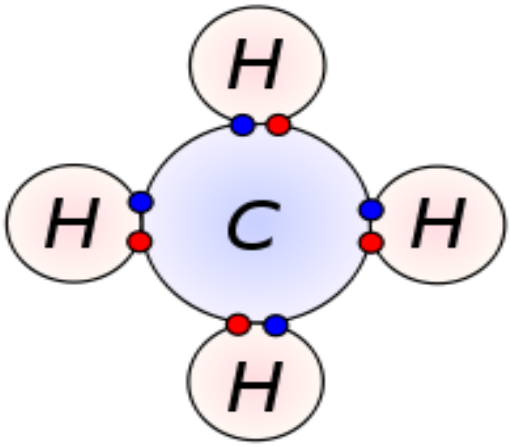
If an atom gains electrons, it has a net negative charge and is known as an anion.

Covalent Bond

A **covalent bond**, also called a **molecular bond**, is a chemical bond that involves the sharing of electron pairs between atoms. These electron pairs are known as **shared pairs** or **bonding pairs**, and the stable balance of attractive and repulsive forces between atoms, when they share electrons, is known as covalent bonding.[1][*better source needed*] For many molecules, the sharing of electrons allows each atom to attain the equivalent of a full outer shell, corresponding to a stable electronic configuration.



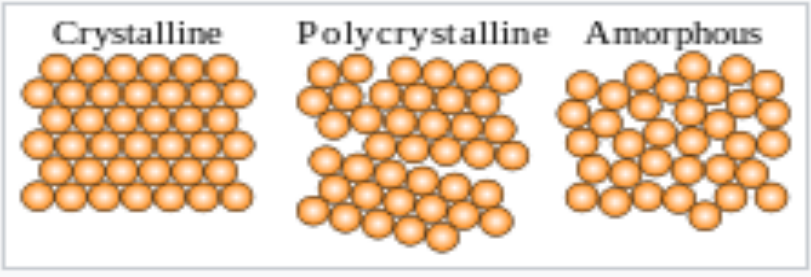
A covalent bond forming H_2 (right) where two hydrogen atoms share the two electrons



Early concepts in covalent bonding arose from this kind of image of the molecule of methane. Covalent bonding is implied in the Lewis structure by indicating electrons shared between atoms.

Crystal

A **crystal** or **crystalline solid** is a solid material whose constituents (such as atoms, molecules, or ions) are arranged in a highly ordered microscopic structure, forming a crystal lattice that extends in all directions.[1][2] In addition, macroscopic single crystals are usually identifiable by their geometrical shape, consisting of flat faces with specific, characteristic orientations. The scientific study of crystals and crystal formation is known as crystallography. The process of crystal formation via mechanisms of crystal growth is called crystallization or solidification.



Microscopically, a single crystal has atoms in a near-perfect periodic arrangement; a polycrystal is composed of many microscopic crystals (called "crystallites" or "grains"); and an amorphous solid (such as glass) has no periodic arrangement even microscopically.

Single Crystal

A **single crystal** or **monocrystalline** solid is a material in which the crystal lattice of the entire sample is continuous and unbroken to the edges of the sample, with no grain boundaries. The absence of the defects associated with grain boundaries can give monocrystals unique properties, particularly mechanical, optical and electrical, which can also be anisotropic, depending on the type of crystallographic structure. These properties, in addition to making them precious in some gems, are industrially used in technological applications, especially in optics and electronics.

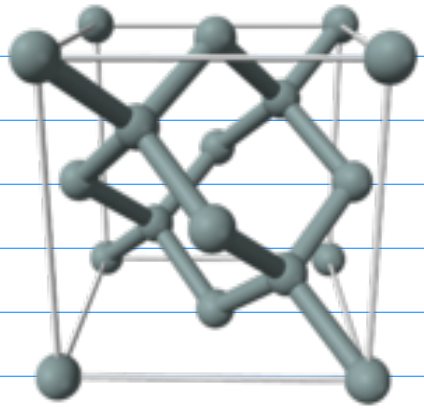
Crystal Structure

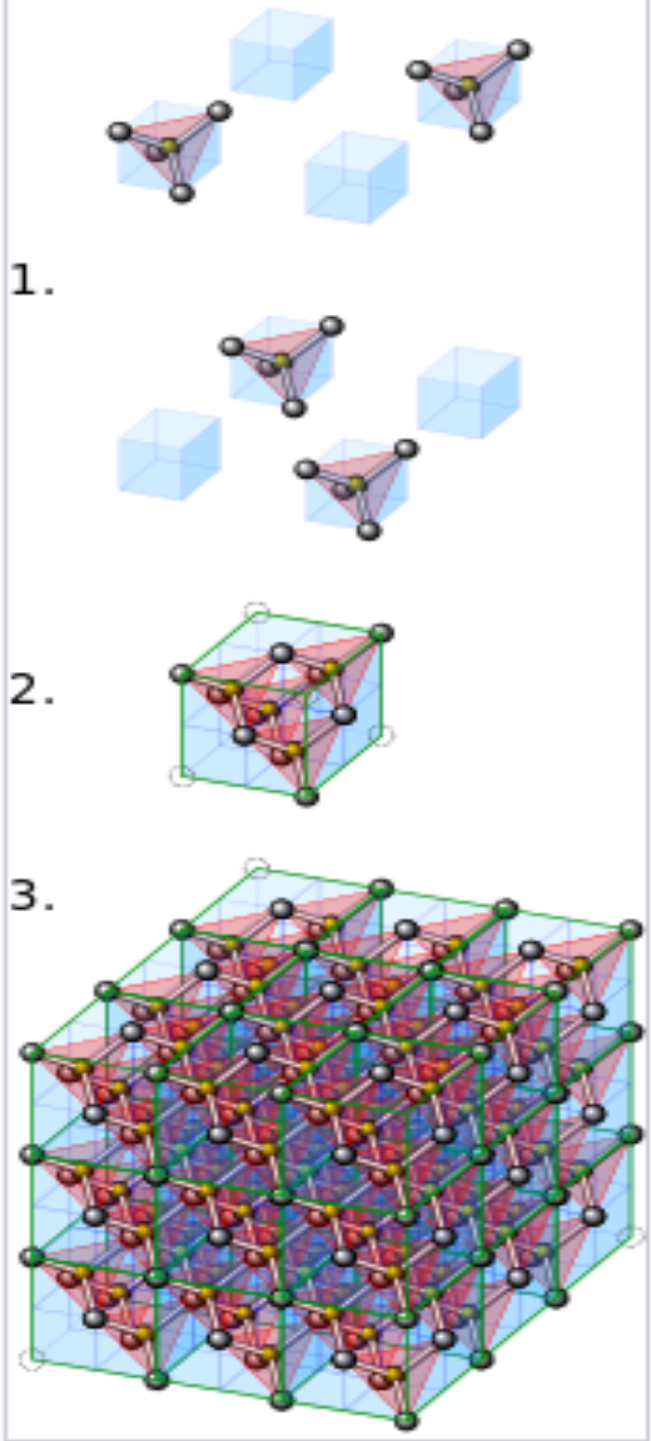
In crystallography, **crystal structure** is a description of the ordered arrangement of atoms, ions or molecules in a crystalline material.[3] Ordered structures occur from the intrinsic nature of the constituent particles to form symmetric patterns that repeat along the principal directions of three-dimensional space in matter.

The smallest group of particles in the material that constitutes the repeating pattern is the **unit cell** of the structure. The unit cell completely defines the symmetry and structure of the entire crystal lattice, which is built up by repetitive translation of the unit cell along its principal axes. The repeating patterns are said to be located at the points of the Bravais lattice.

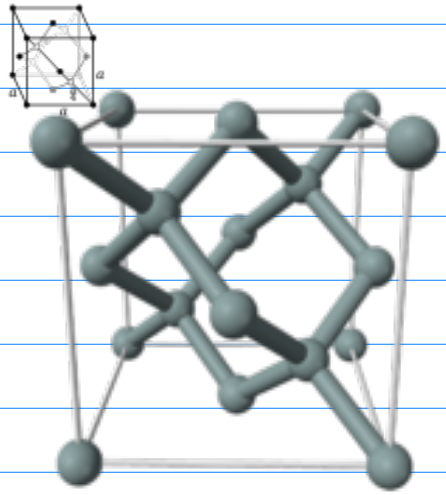
Diamond Cubic

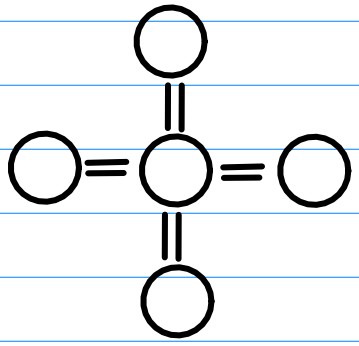
The **diamond cubic** crystal structure is a repeating pattern of 8 atoms that certain materials may adopt as they solidify. While the first known example was diamond, other elements in group 14 also adopt this structure, including α-tin, the semiconductors silicon and germanium, and silicon/germanium alloys in any proportion.





Visualisation of a diamond cubic unit cell: 1. Components of a unit cell, 2. One unit cell, 3. A lattice of 3 × 3 × 3 unit cells





share electrons of neighor atoms

covalent bond