

Answer on Question #77891 - Chemistry - Inorganic Chemistry

Question:

Can the ionisation energy for an ion be negative? If yes please give examples.

Solution:

Energy is an exciting physical quantity. Since the equations of motion do not change over time, there must be some property of the stored system. We call it energy, and if the system does not explicitly depend on time (for example, an isolated atom), we can give it some energy. Interestingly, the exact amount of energy is insignificant. It turns out that we can add any constant to the potential energy of the system, and it will still behave in the same way. This means that we are more or less free to choose a zero energy point.

Speaking of atoms, we are talking about related systems. There is the kinetic energy of electrons, above which they are free, to avoid the effects of the nucleus and below which they overpower the related discrete energy levels. It is natural to identify the zero energy scale with this error. That is why the energy levels of atoms / molecules / condensed matter are negative. The electron in the ground state of the hydrogen atom is about -13.6 eV. This means that 13.6 eV is needed to bring it out of a closed core and release it - it is the energy of ionization, which is defined as the energy absorbed by the atom to lose the electron and become a positive ion. Thus, the ionization energy is always positive, since each individual electron is connected and therefore has negative energy!

What can not be positive is the affinity for an electron. This is a different quantity, which is defined as the energy released when an atom captures an electron and becomes a negative ion. Some atoms may prefer to get another electron, they emit energy, and therefore affinity is positive (atoms that have an almost complete shell, especially chlorine, fluorine, etc.), but some do not like it; they consume energy, therefore, they affinity is negative (atoms that already have a full valentine shell, especially noble gases).