

Answer on Question #79982 - Chemistry - Physical Chemistry

Question:

What are the energy values for each 4 quantum number?

Solution:

In many-electron atoms, as in the hydrogen atom, the electron state is determined by the values of the same four quantum numbers, but in this case the electron is located not only in the field of the nucleus, but also in the field of other electrons. Therefore, the energy in many-electron atoms is determined not only by the principal, but also by the orbital quantum number, or rather by their sum: the energy of atomic orbitals increases with increasing the sum of $n + l$; with the same amount, the level with the smaller n and larger l is first filled. The energy of atomic orbitals increases according to the series

$$1s < 2s < 2p < 3s < 3p < 4s \approx 3d < 4p < 5s \approx 4d < 5p < 6s \approx 4f \approx 5d < 6p < 7s \approx 5f \approx 6d < 7p.$$

Thus, four quantum numbers describe the state of an electron in an atom and characterize the energy of an electron, its spin, the shape of an electron cloud, and its orientation in space. When an atom moves from one state to another, the electron cloud is reorganized, that is, the values of the quantum numbers change, which is accompanied by the absorption or emission of energy quanta by the atom.

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