

## 5.13: Atoms Having More Than One Electron

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After having some familiarity with [the properties of single electrons](#), we can discuss atoms containing more than one electron. The diagrams shown here give a visual representation of the electrons in multi-electron atoms, using a different color for each electron. Use the buttons on the jmol's to toggle electrons on or off.

The following list explains the rules for predicting the electron configurations for atoms. By knowing the configuration of the previous element on the periodic table and by using these rules, determining the electron configuration for an atom having more than one electron is straightforward and simple.

- 1** *The Aufbau principle (building-up principle).* [The structure of an atom](#) may be built up from that of the element preceding it in the periodic system by adding one proton (and an appropriate number of neutrons) to the nucleus and one extranuclear electron.
- 2** *The order of filling orbitals.* Each time an electron is added, it occupies the available subshell of *lowest energy*. The appropriate shell may be determined from a diagram such as Figure 1a which arranges the subshells in order of increasing energy. Once a subshell becomes filled, the subshell of the next higher energy starts to fill.
- 3** *The Pauli exclusion principle.* No more than two electrons can occupy a single [orbital](#). When two electrons occupy the same orbital, they must be of opposite spin (*an electron pair*).
- 4** *Hund's rule.* When electrons are added to a subshell where more than one orbital of the same energy is available, their spins remain parallel and they occupy different orbitals. Electron pairing does not occur until it is required by lack of another empty orbital in the subshell.

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