

Electron Configuration Summary

Energy Level: (Which **Floor**?) distance from the nucleus:

$n = 1, 2, 3, 4, 5, 6, 7 \dots$

also called the Principle Quantum number

Sublevel: s, p, d, f (Which **Apartment** on that floor?) describes the shape of orbital:

Number of *sublevels* in a given energy level (n) is equal to n .

Energy Level 1 has 1 = s

Energy Level 3 has 3 = s, p, d

Energy Level 2 has 2 = s, p

Energy Level 4 has 4 = s, p, d, f etc.

Orbital: (Which **Room** in the apartment?) orientation in space of the atomic orbital:

Each type of sublevel (or shape) has different numbers of *orbitals*

s has 1 orbital

p has 3 orbitals

d has 5 orbitals

f has 7 orbitals

*****Total orbitals in an energy level = n^2

Electron: (Which **Person**?) Which electron in the orbital? (Spin Quantum number)

There can be at most 2 *electrons*, with opposite spins, in any orbital.

s has 2 electrons

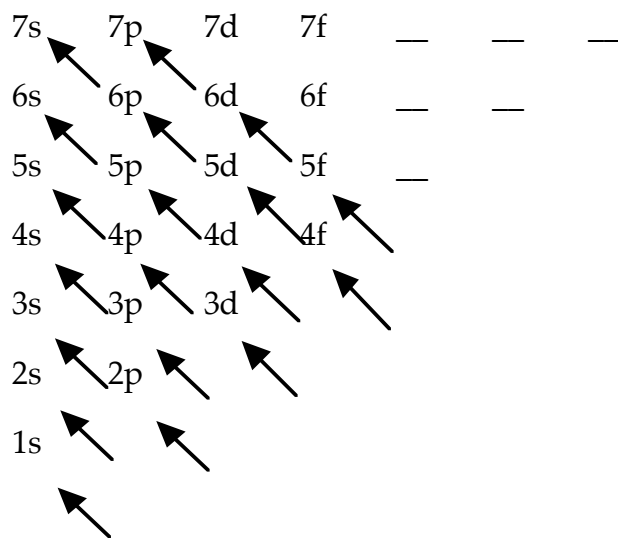
p has 6 electrons

d has 10 electrons

f has 14 electrons

****Maximum number of electrons in an *energy level* = $2n^2$

Diagonal rule: The energy (and filling order) of the sublevels follows a diagonal pattern. For example, the 4s is lower energy than, and *filled* before, the 3d, even though the 4s is farther from the nucleus than the 3d. Would you rather walk up 1 more flight of stairs, but be in an apartment with 2 people, or be closer to the ground floor, in an apartment with 10 people?



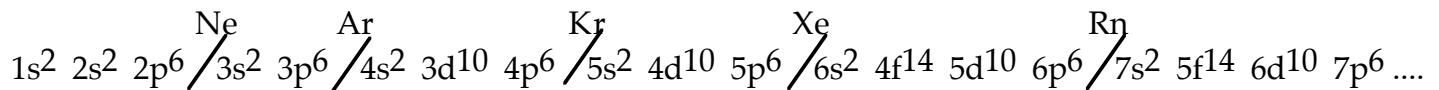
Each row across represents an energy level (or floor). The higher in the chart, the farther from the nucleus the level is.

The s, p, etc. represent sublevels (apartments). For example, "4s" means the s sublevel of the 4th energy level.

Notice that the number of sublevels in any energy level is equal to the number of that level. (4th energy level has 4 sublevels)

These three principles govern the filling order of orbitals by electrons.

1. Aufbau Principle: Electrons enter orbitals of lowest energy first. The diagonals in the above diagram show this order. The superscripts tell how many electrons can occupy that sublevel.



So, to get the electron configuration of an atom, start with $1s^2$, and keep adding electrons in the above order until you reach the number of electrons in the atom (the atomic number).

Nitrogen = 7 electrons, Superscripts must total 7 = $1s^2 \ 2s^2 \ 2p^3$

2. Pauli Exclusion Principle: An orbital contains a maximum of two electrons, with opposite spins.
3. Hund's rule: When electrons occupy orbitals of equal energy, one electron enters each orbital until all the orbitals contain one electron with spins parallel.