Electron Configuration

[Click here to go to the online electron configuration app](http://employees.oneonta.edu/viningwj/sims/atomic_electron_configurations_s1.html).

Answer the following questions using the app to learn about how electrons fill atomic energy levels. Note:

* The letters s, p, d and f are called “sub-levels”. Each energy level (n = 1, n = 2, etc.) can be divided into sub-levels.
* Each box in a sub-level is an orbital.
* Half arrows represent electrons and are placed in the orbitals to show how they fill each sub-level.
* The diagram shown is called an *Aufbau diagram* or *orbital diagram*. The actual electron configuration is shown in the light gray box that says “spectroscopic or spdf noble gas notation.”

1. How many sub-levels are there in energy level 1?

One.

1. How many sub-levels are there in energy level 2?

Two.

1. How many sub-levels are there in energy level 3?

Three.

1. How many orbitals does a p sub-level have?

Three

1. How many orbitals does an s sub-level have?

One.

1. How many orbitals does a d sub-level have?

Five.

1. How many electrons can fit in an orbital?

Two (different directions?)

1. How many electrons can fit in the s sub-level? How many electrons can fit in the p sub-level? How many electrons can fit in the d sub-level?

Two; six; ten.

1. Following this pattern, if a g sub-level came after the f sub-level, how many orbitals would it have?

Nine.

1. Use the simulation to observe the Aufbau diagrams for the first 10 elements and record their electron configurations.
2. The number of electrons each element has equals to its atomic number.
3. The electrons fill each energy level in order of the displacement in the app (first 1s then 2s, 2p, 3s, 3p, 4s, 3d, 4p, 5s, 4d, etc.
4. Predict the Aufbau diagrams and electron configurations for elements 11 through 18.

Element 11: with full electrons in 1s, 2s, 2p, and one electron (an arrow upwards) in 3s.

1. How do the energy levels and sub-levels relate to the periodic table?

The first line (horizontal) in the periodic table corresponds the energy level n = 1, the second corresponds to n = 2, etc.

1. Explain how the electron configuration of an element can deduced using the periodic table.
2. The atomic number equals to the electron (arrows) in total.
3. The line (horizontal) determines which energy levels the electrons are in.
4. For elements higher than atomic number 10, the electron configuration shown in the app begins with the symbol for a noble gas in brackets (i.e. sodium is [Ne]3s1). Deduce the meaning of this notation.

That means based on the electron configuration of Ne, Na adds one electron in the orbit 3s.

Hint: write the full electron configuration for sodium and compare it to other electron configurations you’ve written. For some help with this, you [can check out this video](https://www.youtube.com/watch?v=ououF9nHUhk).

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Valence Electrons

*Valence electrons* are the electrons in an atom that occupy the highest energy level. Deduce the number of valence electrons for the following elements.

1. Lithium 1
2. Sodium 1
3. Potassium 5
4. Beryllium 2
5. Magnesium 2
6. Calcium 2
7. Strontium 2
8. Fluorine 7
9. Chlorine 7
10. Bromine 7
11. Iodine 7
12. Carbon 4
13. Nitrogen 5
14. Oxygen 6
15. Phosphorus 5
16. Sulfur 6
17. Aluminum 3

The number of valence electrons is the same in each vertical line.

Identify any patterns in the answers above. Use these patterns to deduce how the periodic table can be used to quickly deduce the number of valence electrons in an atom.