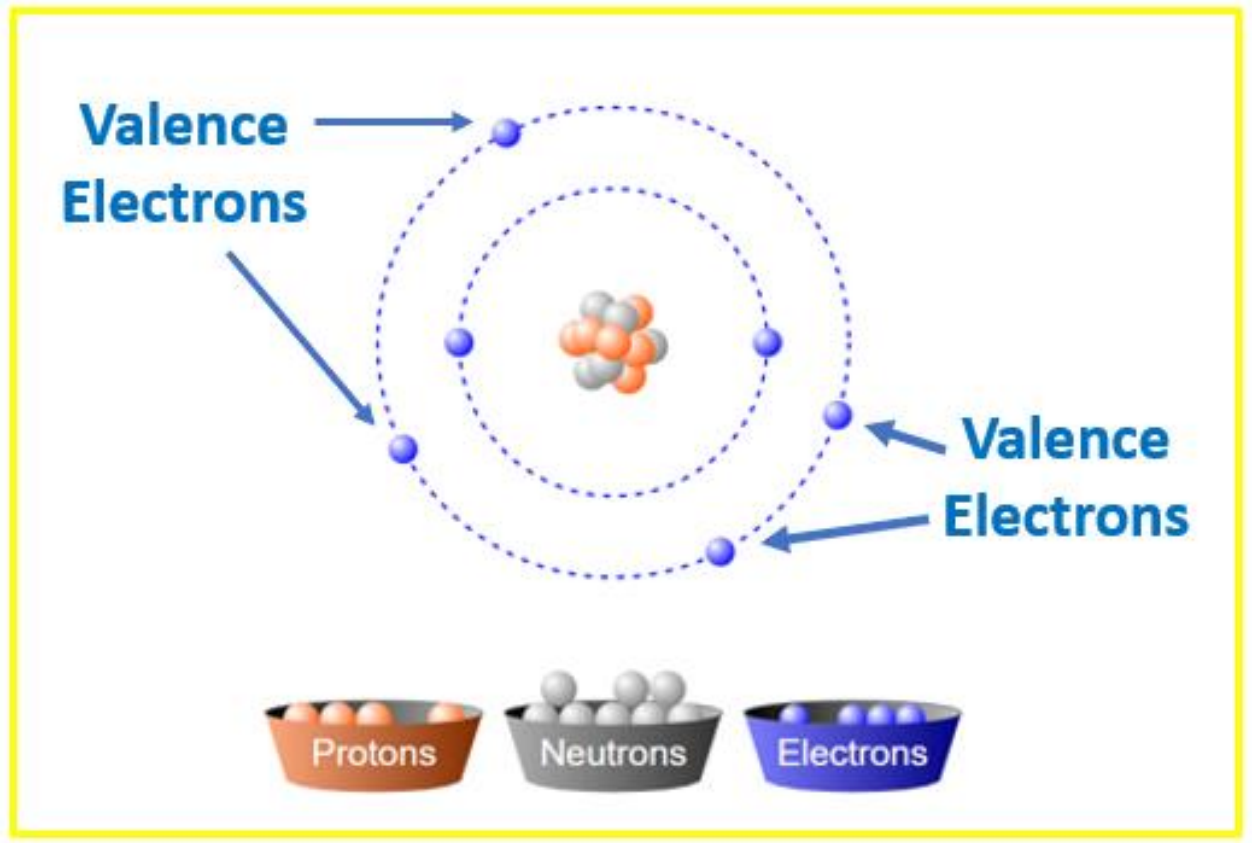
Electron Arrangement



I Can Statements

At the end of this lesson, you should be able to say, with confidence:

- I can explain how electrons are arranged in energy levels and draw Bohr Model diagrams.
- I can explain how elements are arranged in rows on the periodic table according to their number of energy levels.
- I can identify valence electrons for any element and draw their Lewis Structure diagram.
- I can explain how elements are arranged in columns on the periodic table according to their valence electrons.

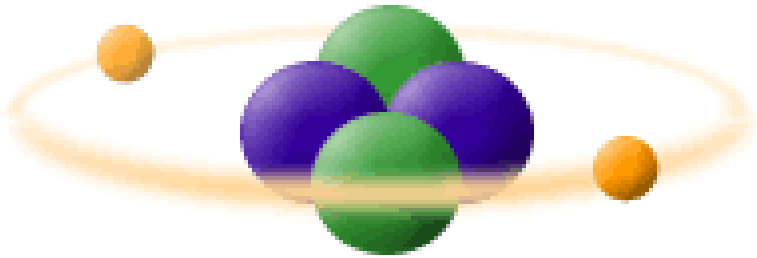
Basic Atomic Structure

Recall that protons and neutron are found in the nucleus of an atom and that electrons orbit around the nucleus.

PROTON
has a positive charge

NEUTRON
has no charge

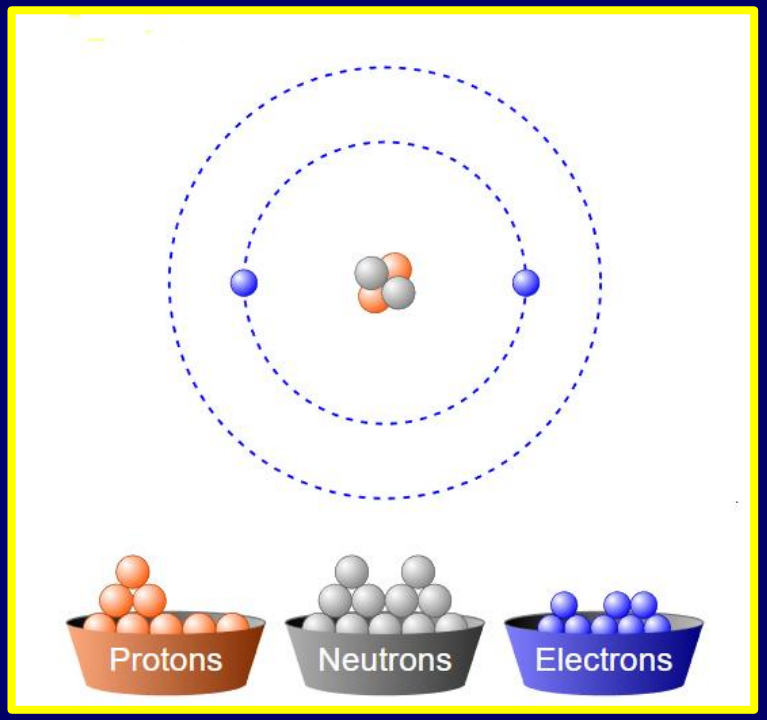
ELECTRON
has a negative charge



Helium

Energy Levels

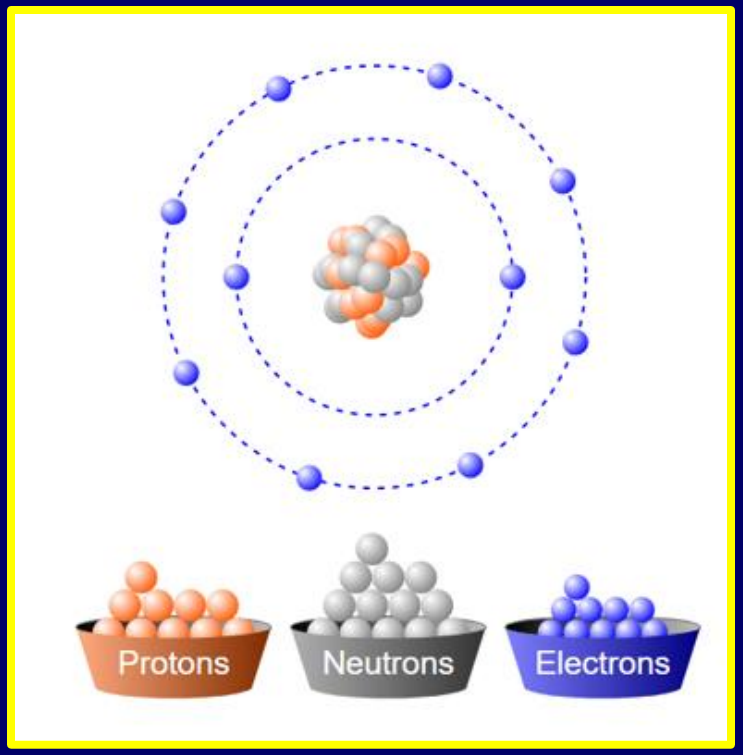
As electrons orbit the nucleus, they arrange themselves into very specific regions called energy levels.



The 1st energy level, located near the nucleus, can hold 2 electrons.

Energy Levels

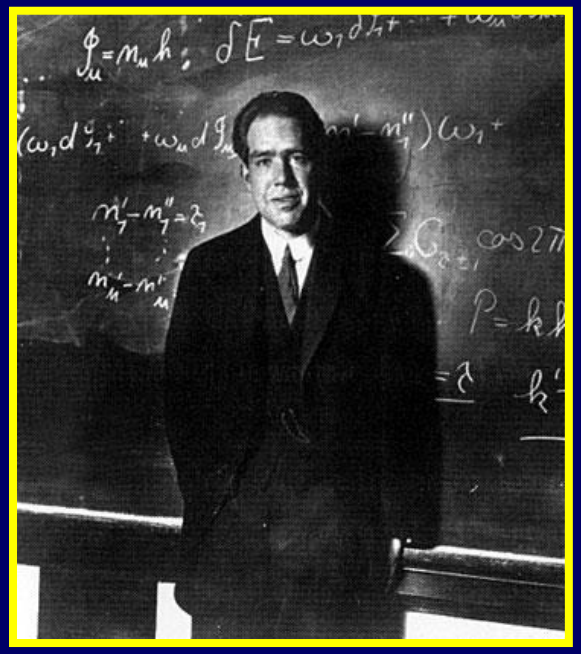
As energy levels get further from the nucleus, they become larger and can hold more electrons.

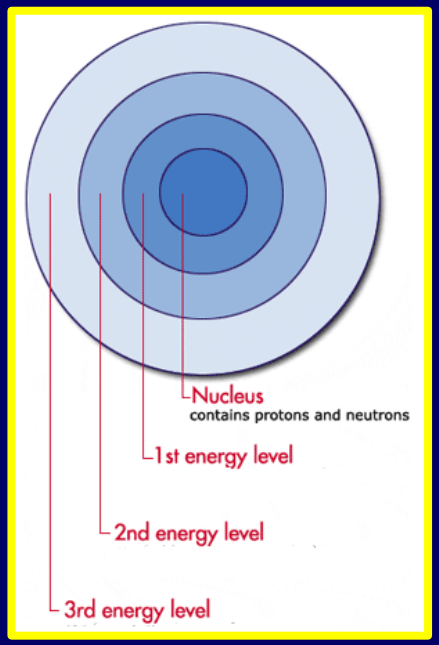


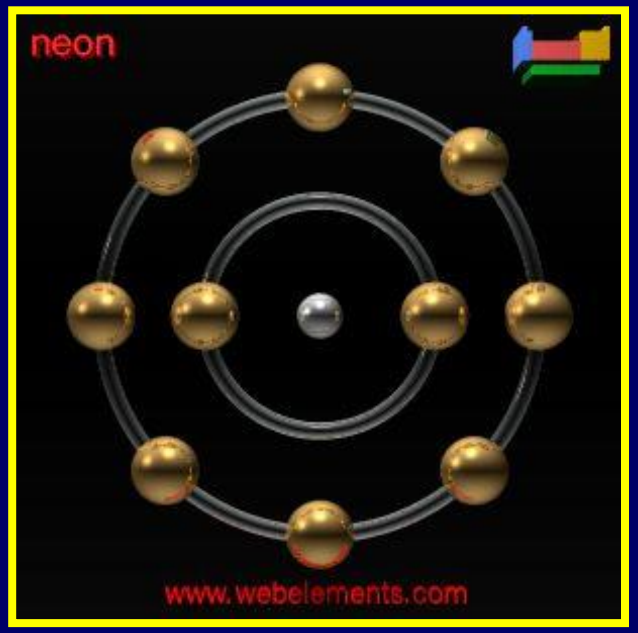
The 2nd energy level can hold 8 electrons.

Bohr Models

Models of atoms, displaying how electrons are arranged, are called Bohr Models, after Niels Bohr who discovered that electrons travel within energy levels.

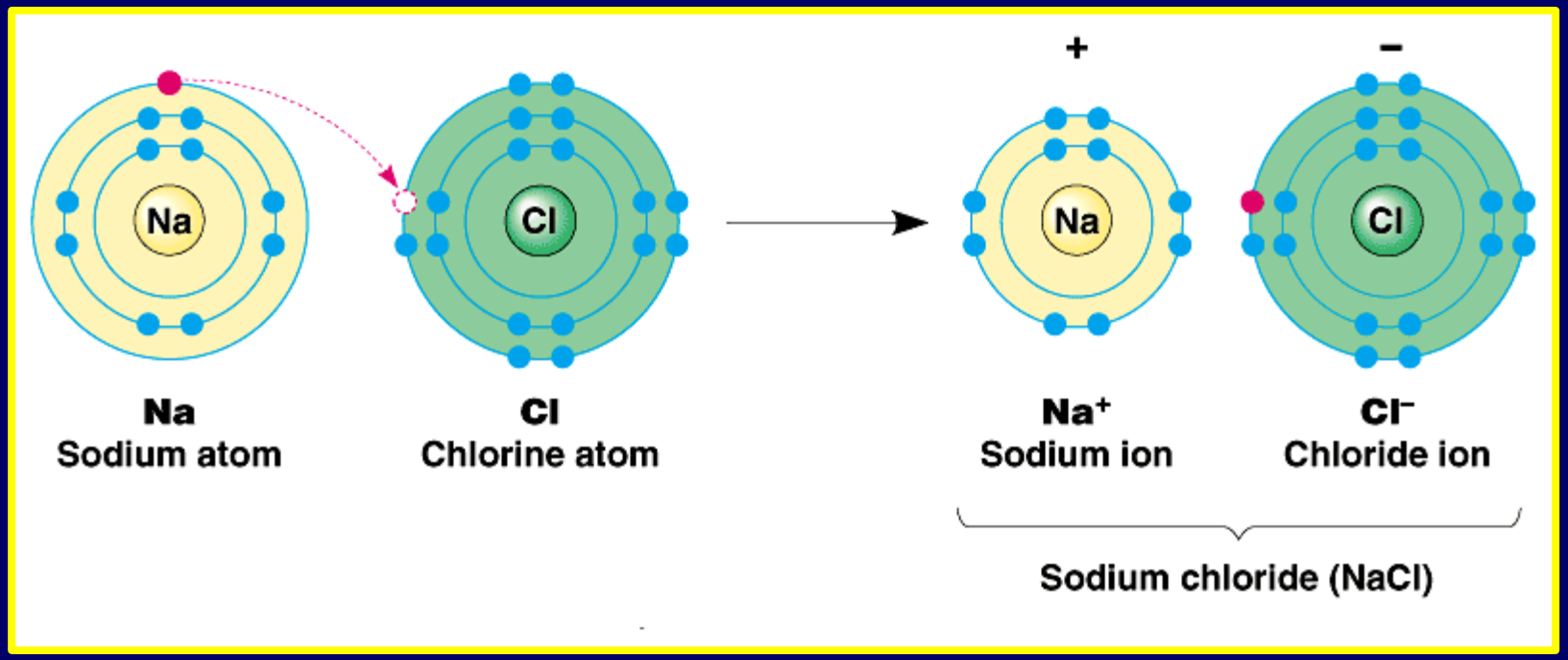






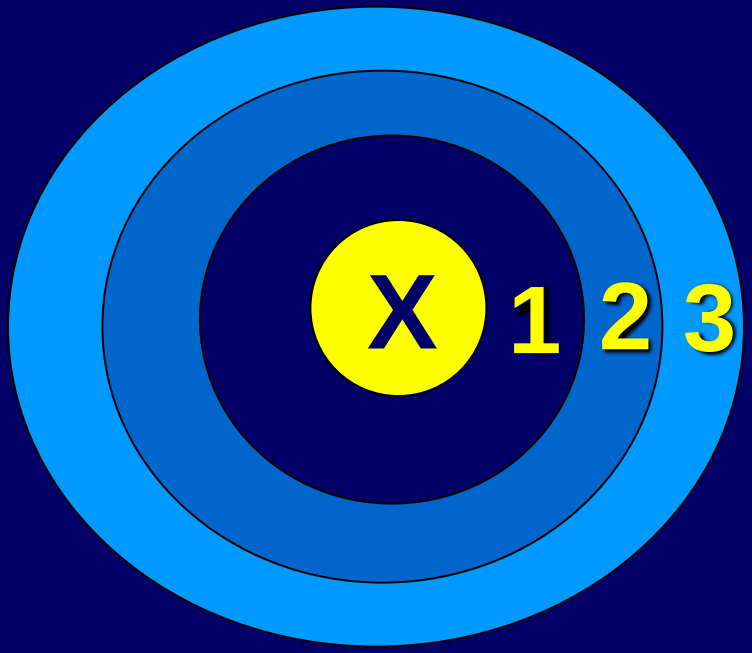
Relevancy?

How electrons are arranged determines how elements will react during a chemical reaction.



Drawing Bohr Models

When drawing Bohr Models of atoms, always begin with the nucleus and work outwards.



X Nucleus

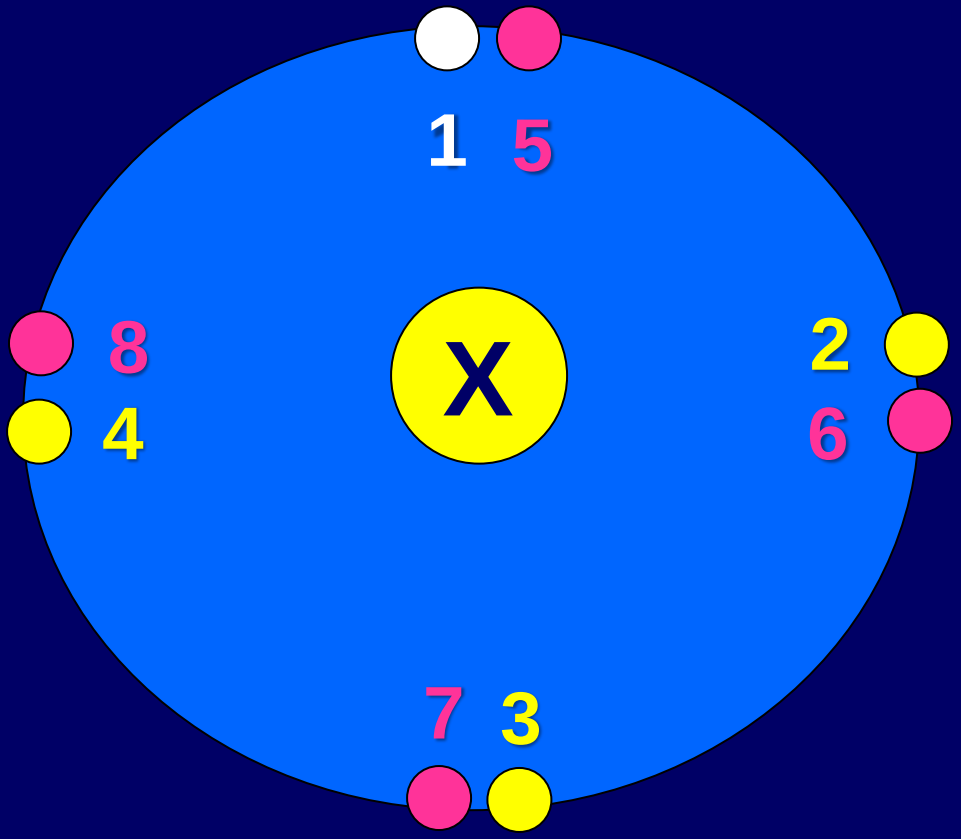
1 1st Energy level

2 2nd Energy level

3 3rd Energy level

Drawing Bohr Models

As a general rule, when drawing electrons, the electrons are placed clockwise around the energy level, beginning with 12 o'clock.

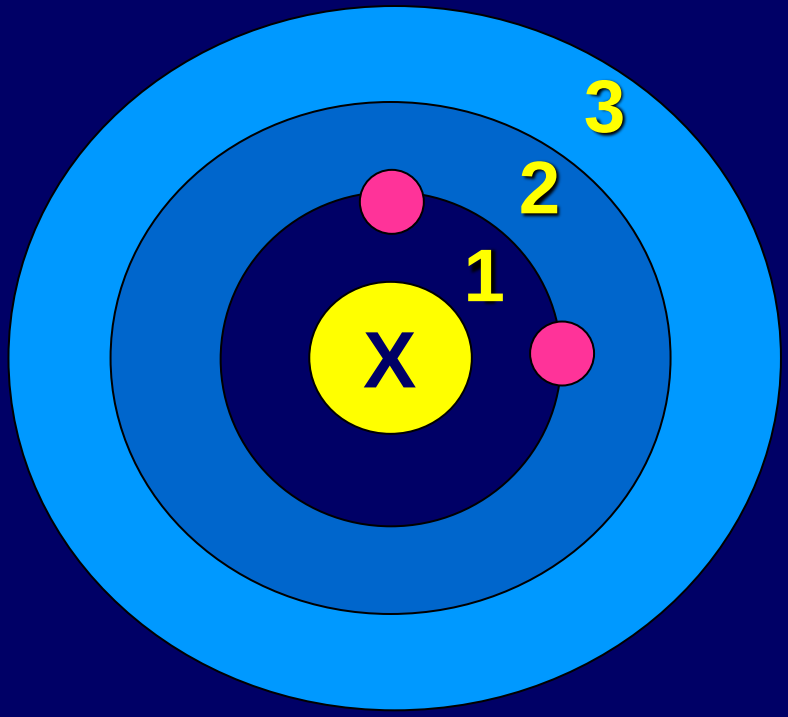


The electrons are then placed at 3 o'clock, 6 o'clock, and 9 o'clock.

Only after an electron is drawn in all four positions, are electrons paired up.

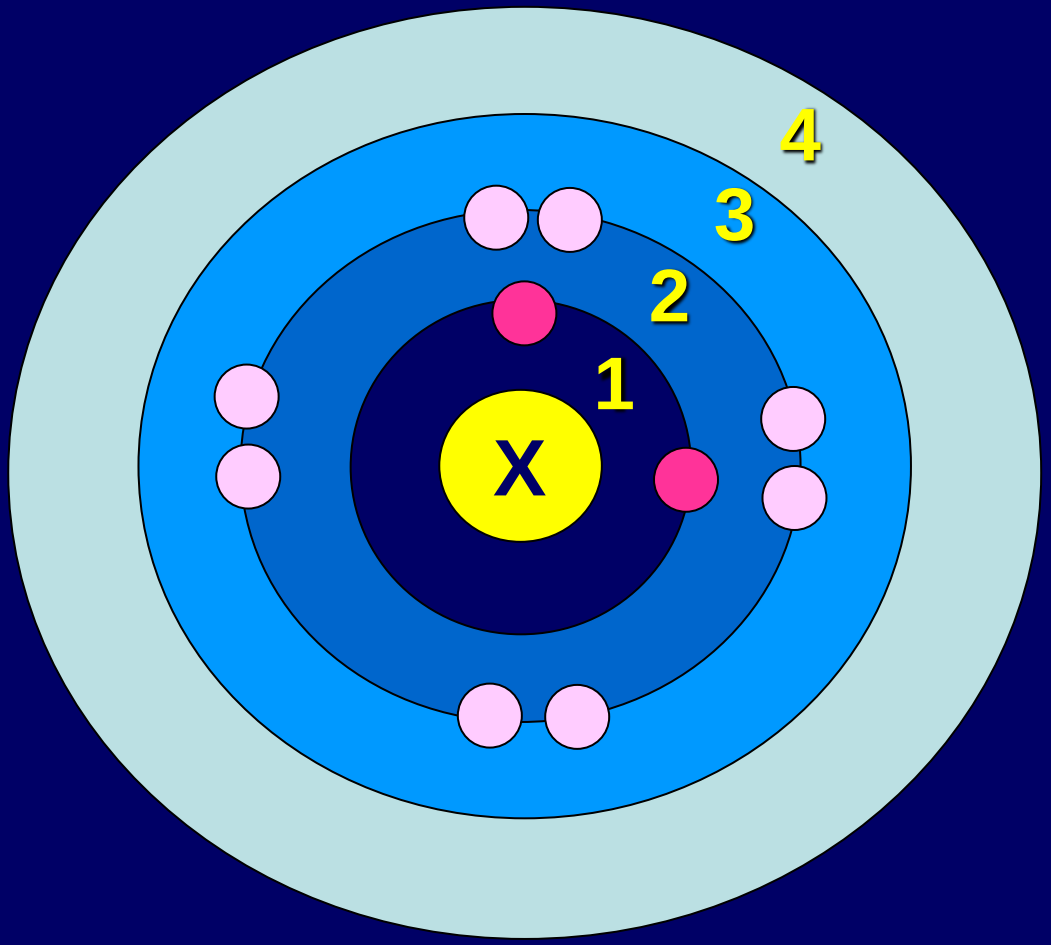
First Energy Level

The first energy level is the smallest and can only hold up two electrons.



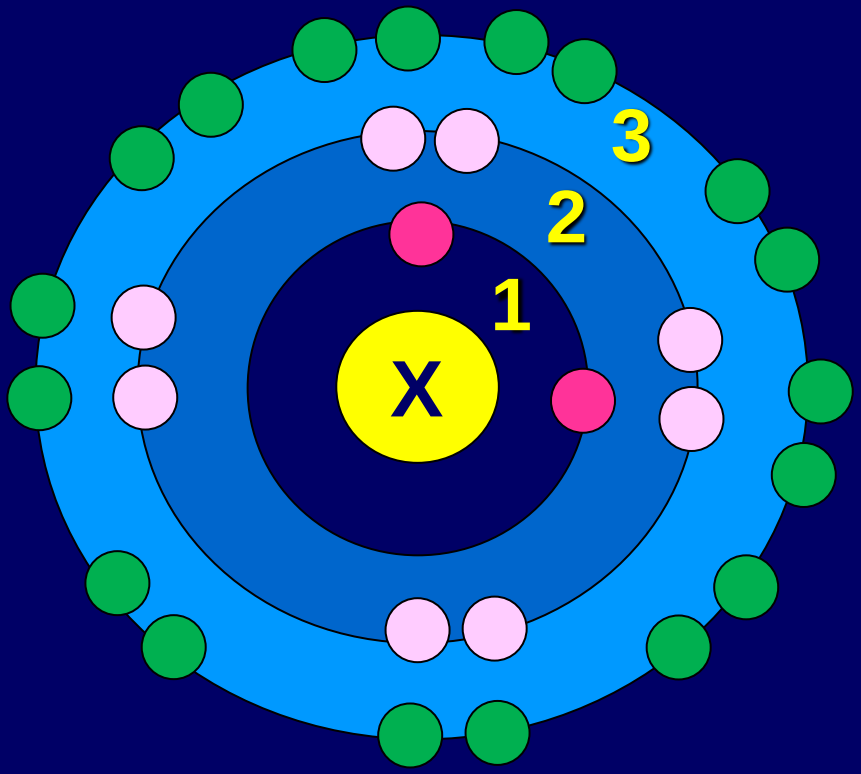
Second Energy Level

The second energy level can hold up to eight electrons.



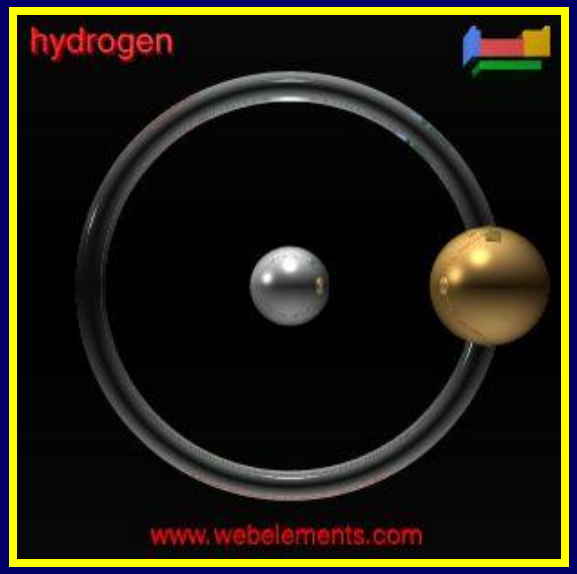
Third Energy Level

The third energy level can hold up to eighteen electrons.

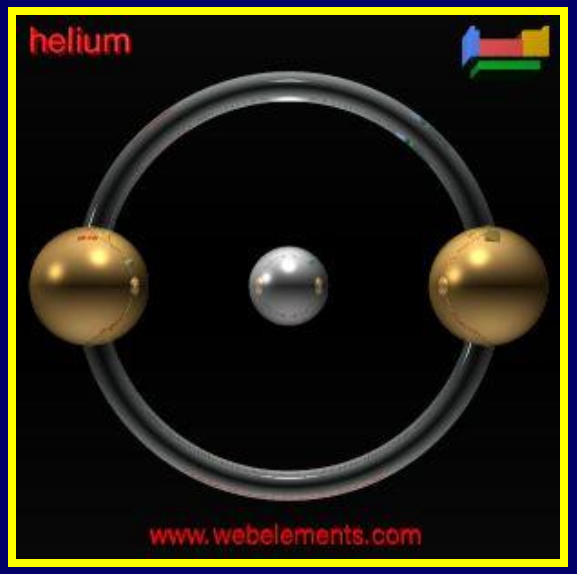


Drawing Bohr Diagrams

Hydrogen and Helium have only one energy level which can hold up to 2 electrons.



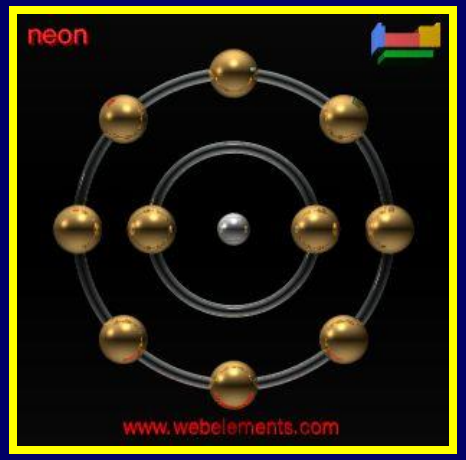
Hydrogen



Helium

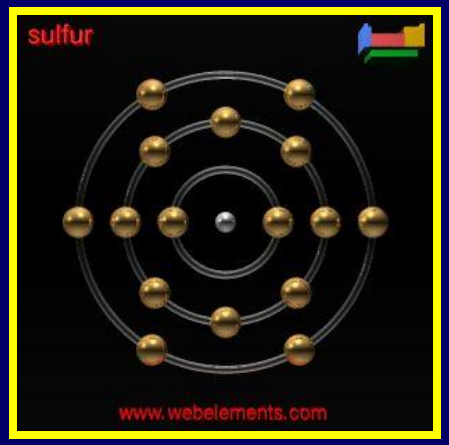
Drawing Bohr Diagrams

Lithium through Neon have two energy levels with the outer one holding up to 8 electrons.



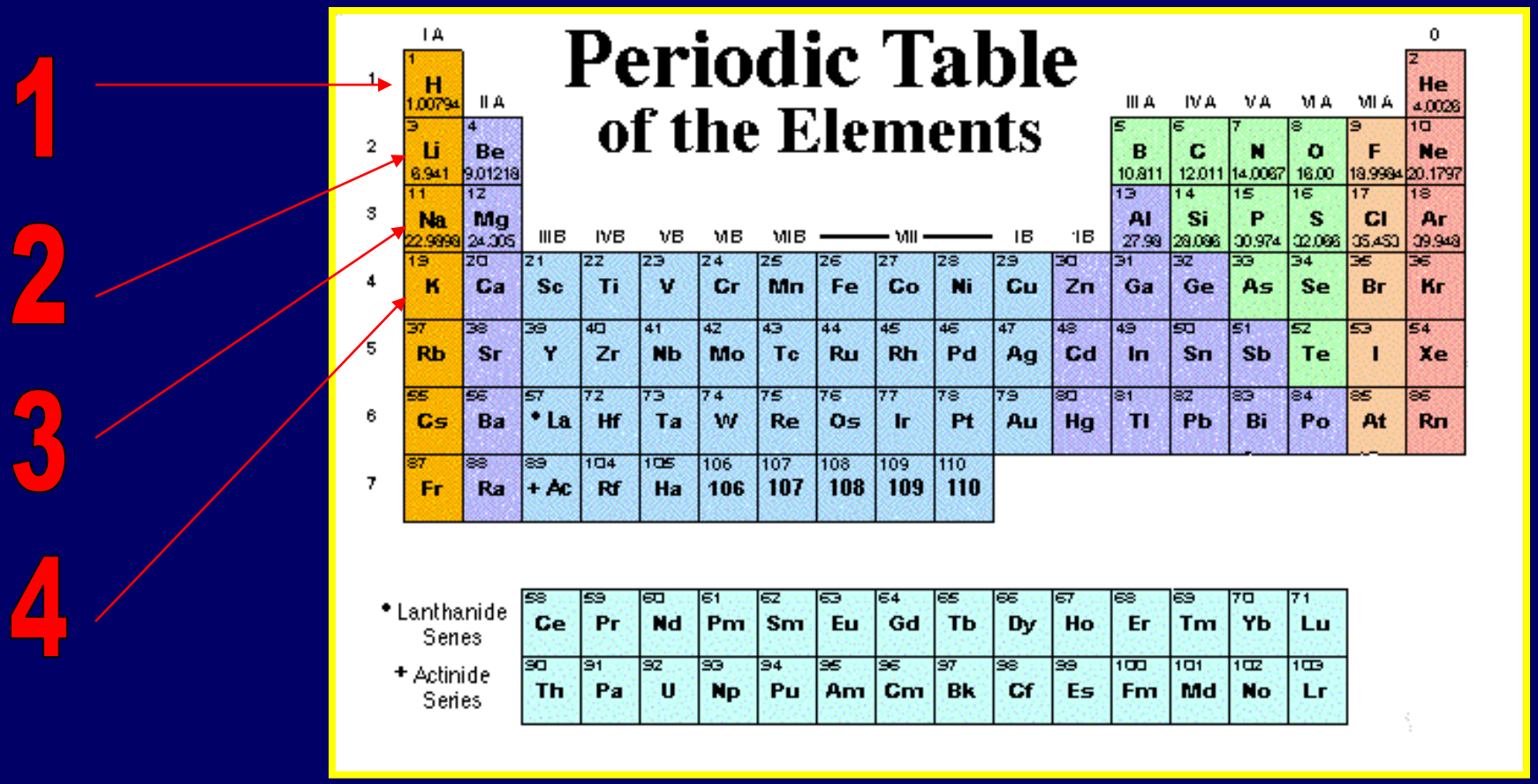
Drawing Bohr Diagrams

Sodium through Argon have three energy levels with the outer one still only holding up to 8 electrons.



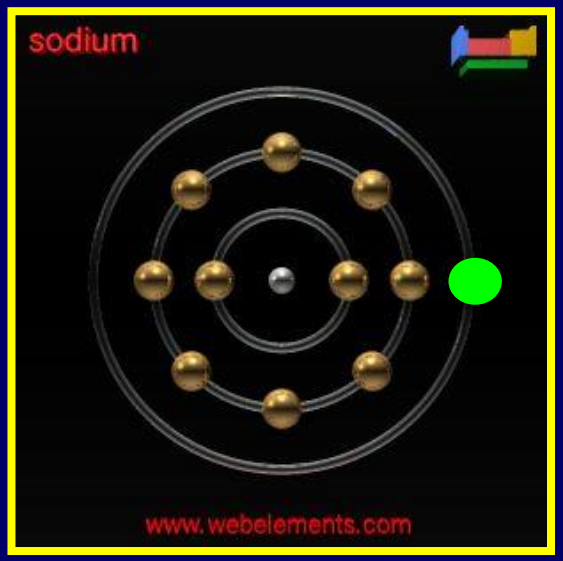
Periods

Elements are placed in rows, called periods, on the periodic table, according to similar number of energy levels.



Valence Electrons

During chemical reactions, only the outer electrons are involved. Therefore, these outer electrons are given a special name and are called valence electrons.

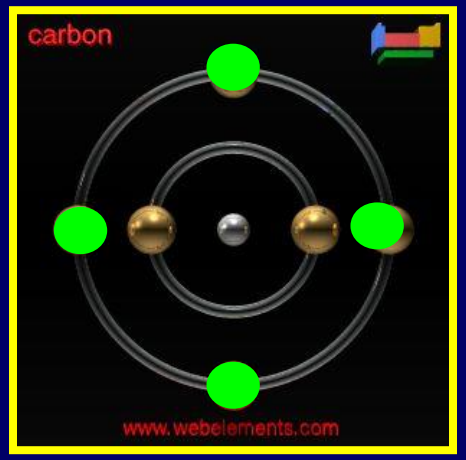


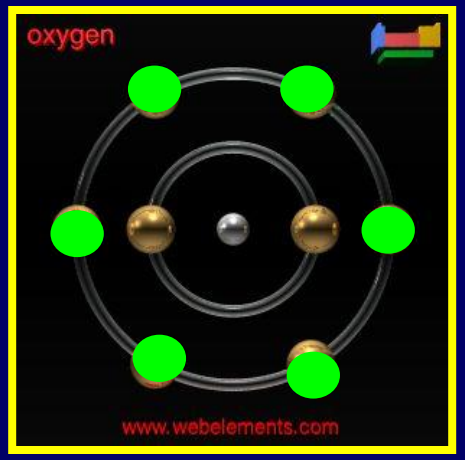
Sodium has 1 valence electron

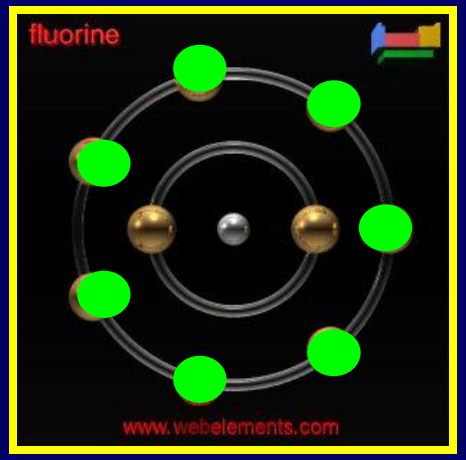
Magnesium has 2 valence electrons

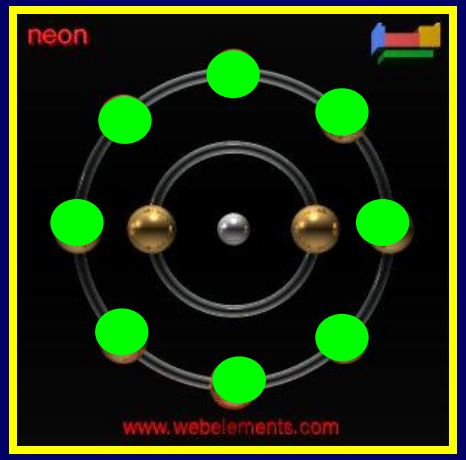
Octet Rule

The Octet Rule states that any element can only hold up to 8 valence electrons.



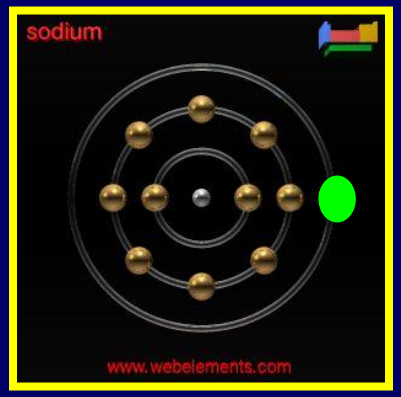


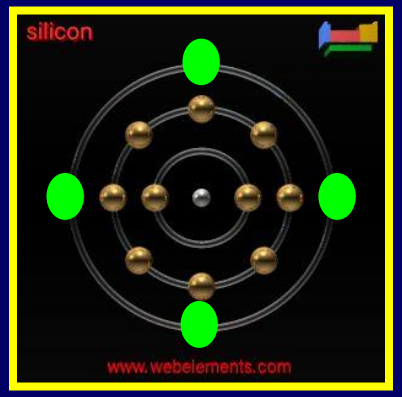


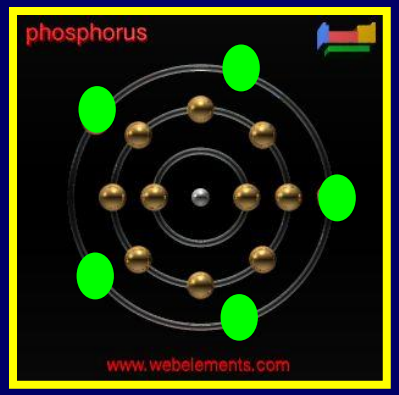


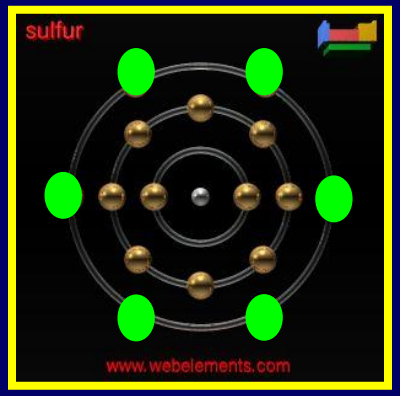
Octet Rule

On the 4th row, the outer energy level would hold more than 8 valence electrons, violating the Octet Rule. So, the extra electrons are pushed up to a higher energy level.



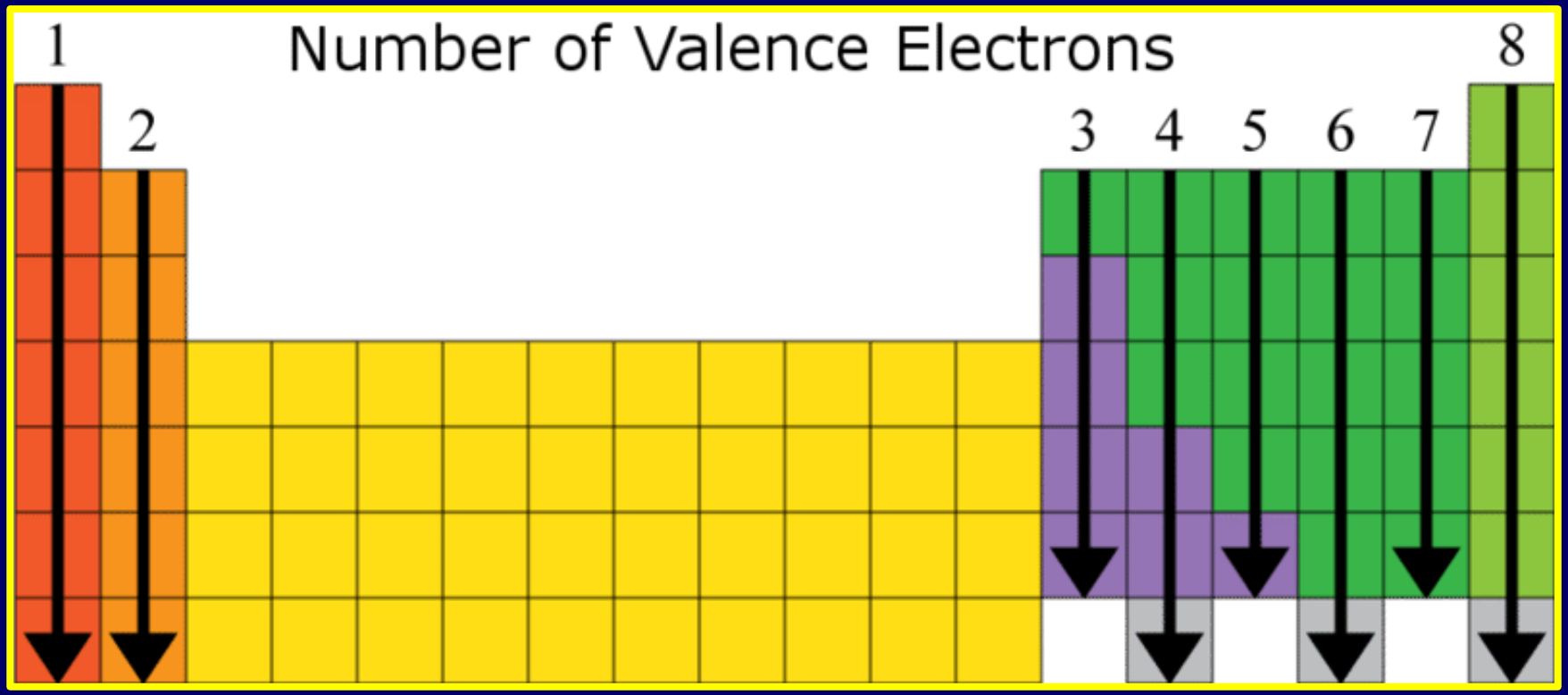






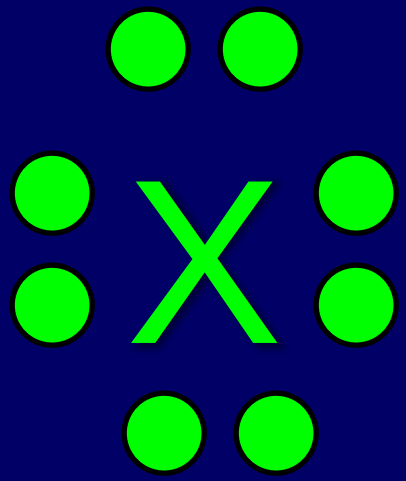
Groups

Elements are placed in columns, called groups, on the periodic table, according to similar number of electrons in their outer energy level.



Lewis Structures

Because the outer valence electrons predict how atoms behave during chemical reactions, they are often represented by diagrams called Lewis Structures.

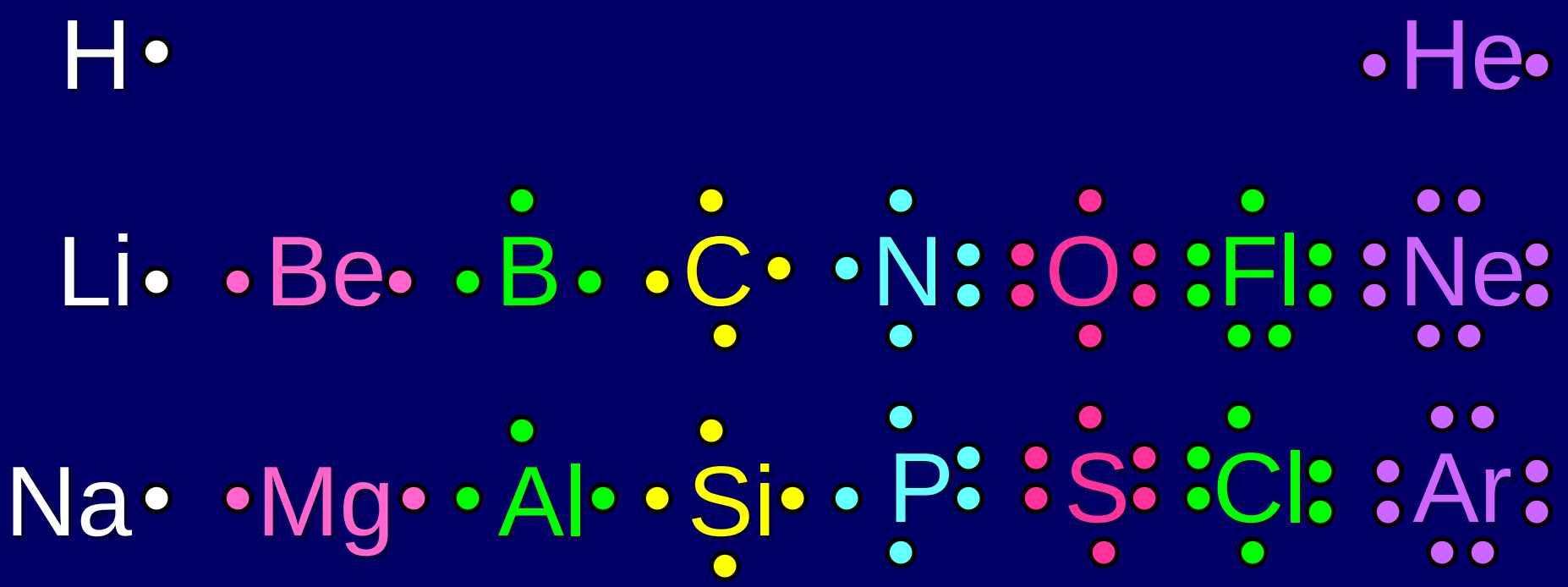


Lewis Structures place only the valence electrons around the chemical symbol for the atom.

The general rule is to work clockwise around the chemical symbol, before any electrons are paired.

Lewis Electron Dot Structures

Lewis Structure diagrams show only the valence electrons around the chemical symbol.



The End