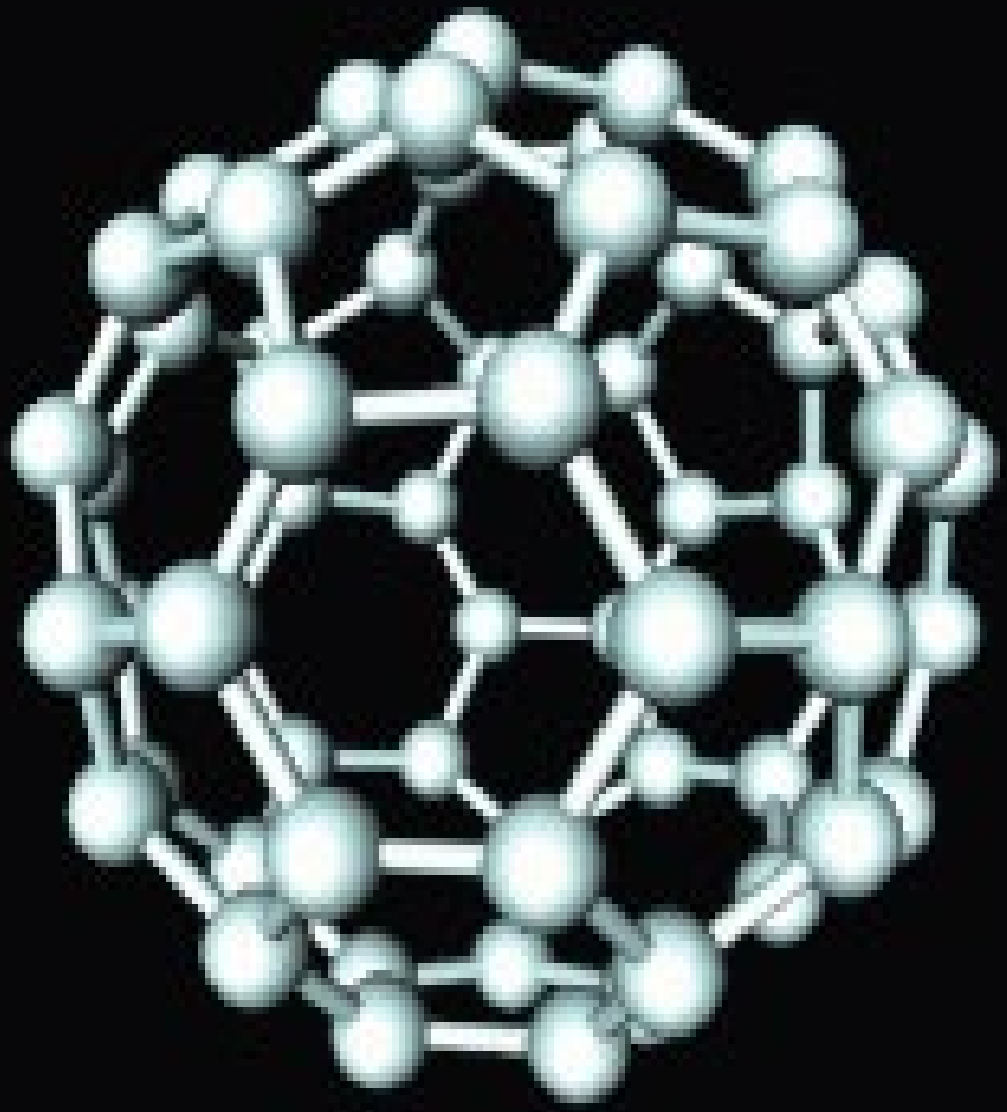
Science 10 Unit A - Chemistry

Your Periodic Table



what do you know about:

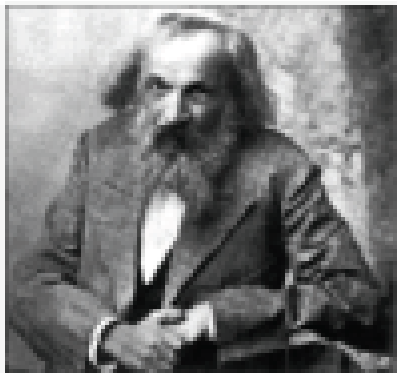
the periodic table?

The structure of an atom, trends in reactivity and much more can be understood by examining the periodic table.

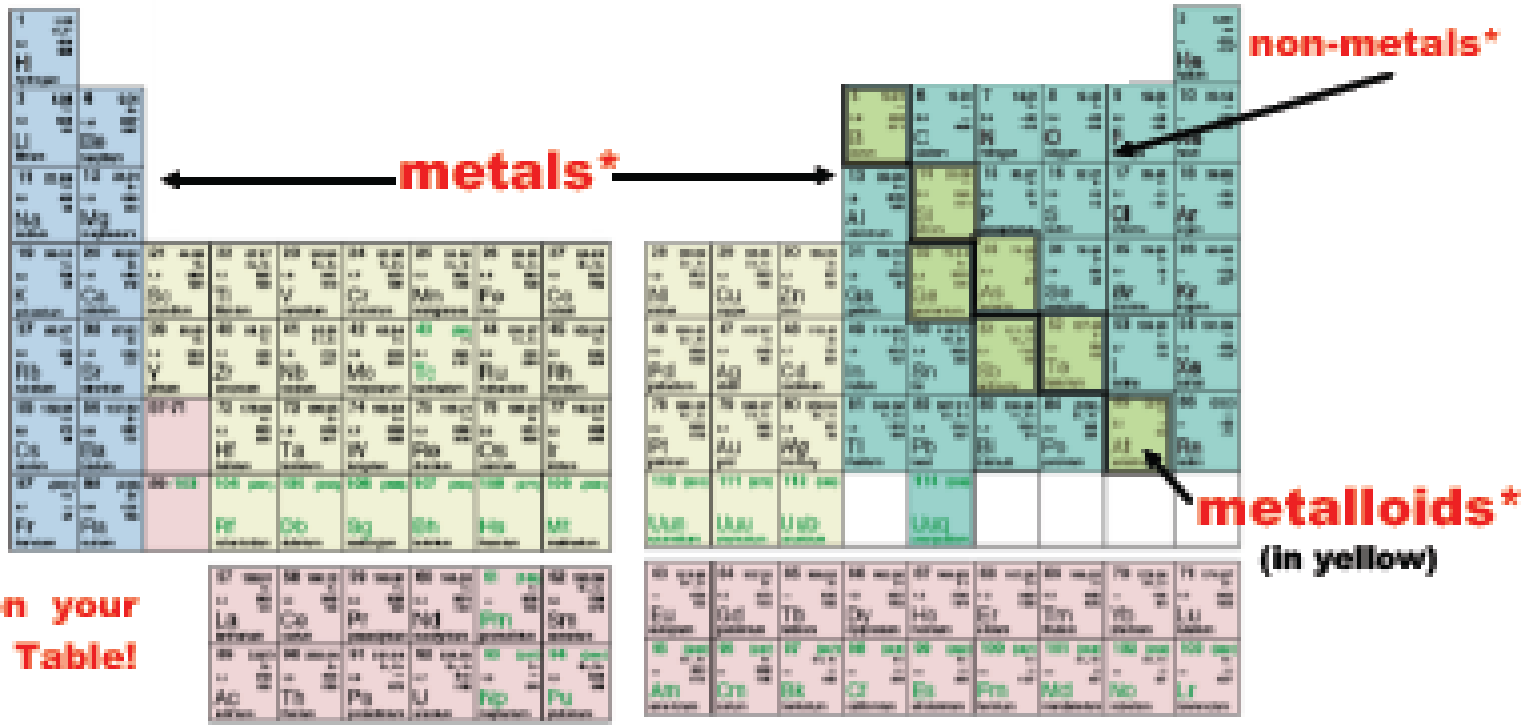
So take out your new boyfriend/girlfriend: the periodic table!

Some Back-story...

The form we use today was created in 1869 by Russian Scientist Dmetri Mendeleev.

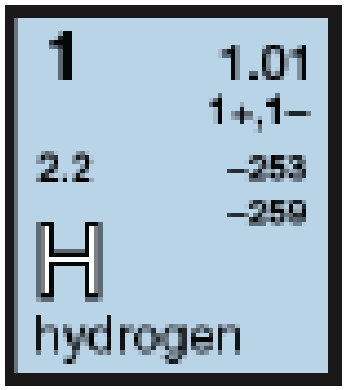


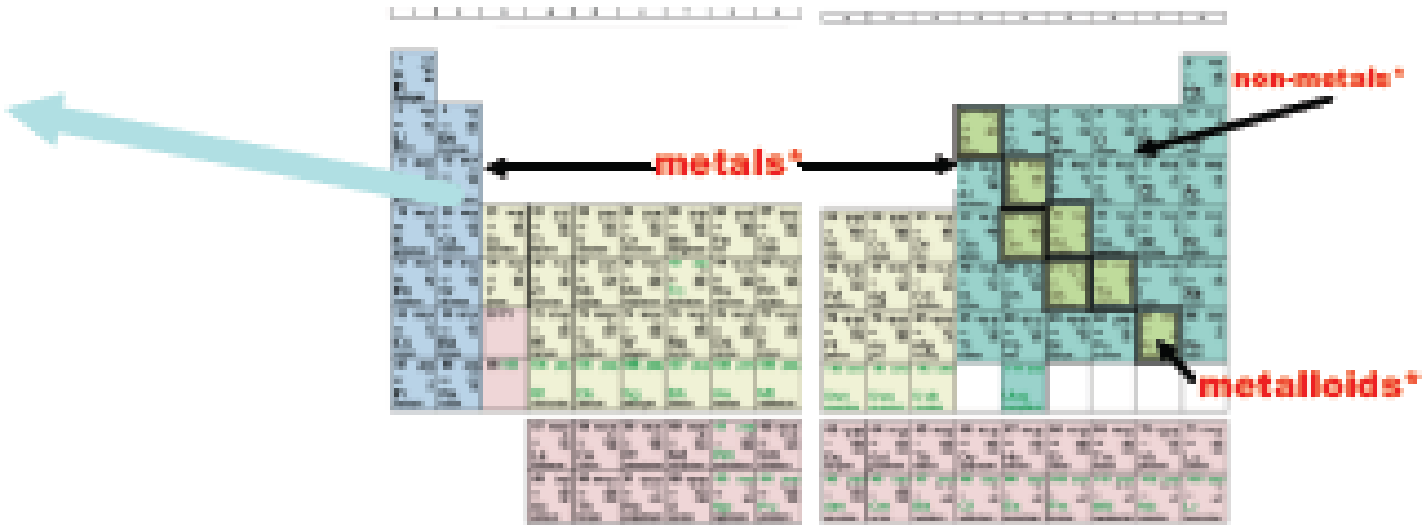
He arranged the elements into three main categories:



*Label on your Periodic Table!

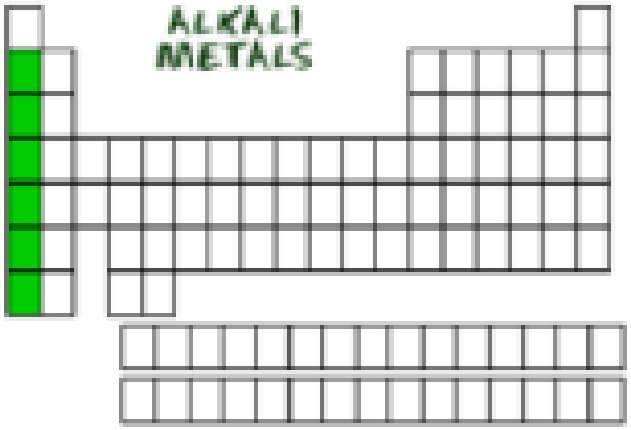
Of course, there were some weirdos that didn't quite fit in.

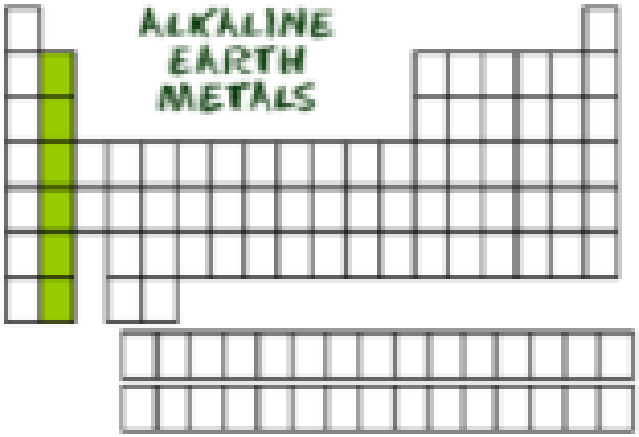


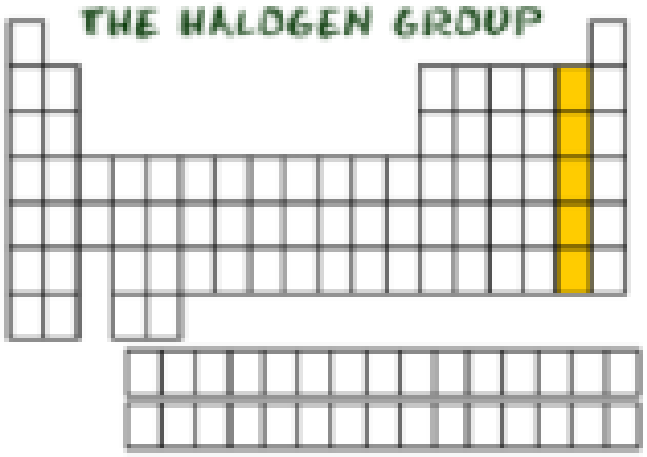


Although hydrogen isn't a metal, it still gets put on the metal side (for weirdness).

And like any table, it has its cliques and special groups:
(label on your periodic table!)







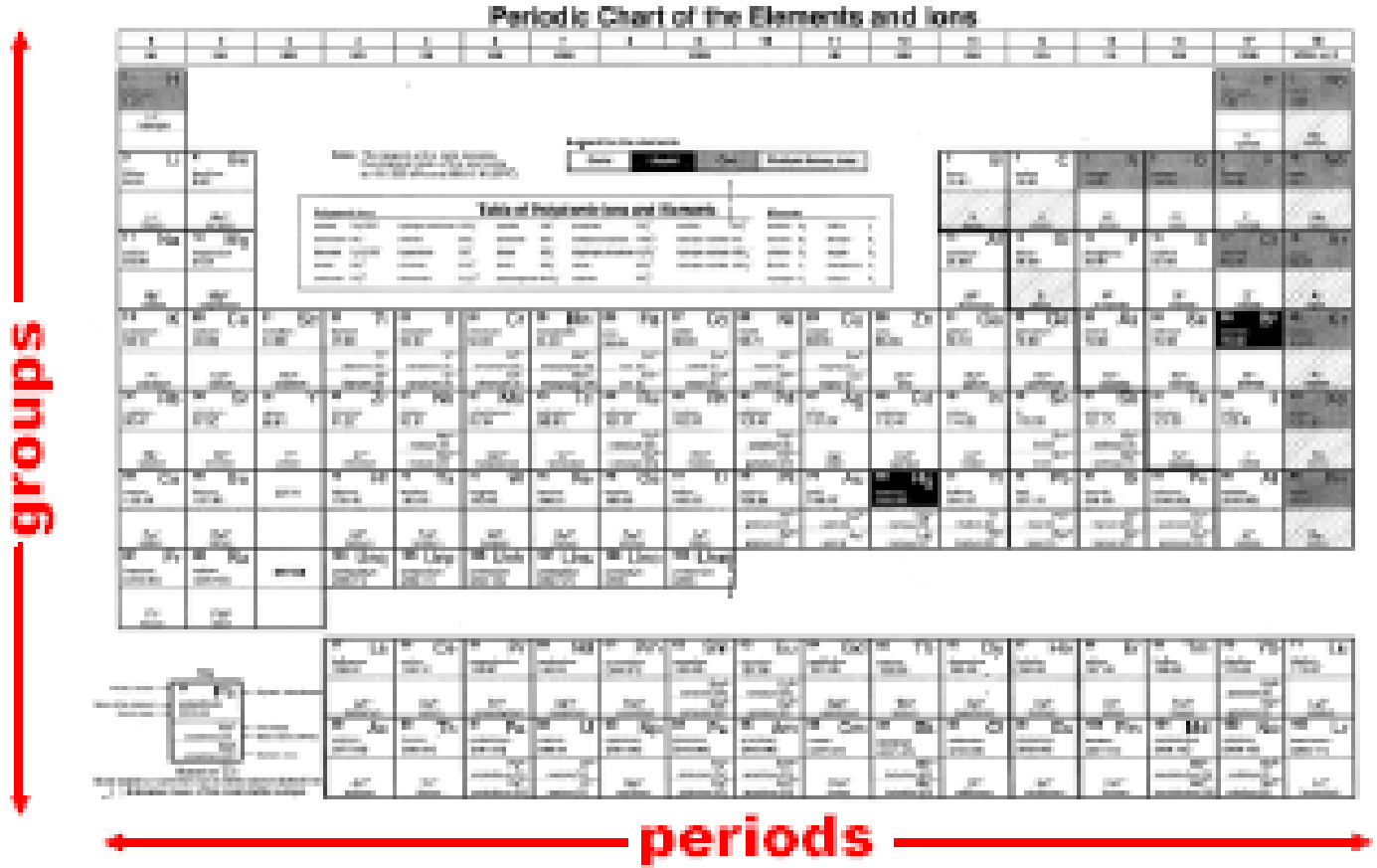
noble (inert) gases

Each group had its special properties:

- alkali metals react violently with water
- halogens form poisonous gases and travel in pairs

The noble gases were interesting: they do not usually form bonds with other elements.

The table is arranged into groups or families (up and down) and periods or rows (left and right).

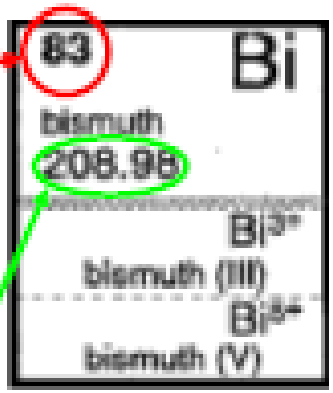


Label on your periodic table!

Other Qualities of the Table:

- number in the upper left hand corner is the atomic number (number of protons and electrons in an atom)

ex) We know an atom of bismuth has 83 protons and 83 electrons because the atomic number is 83.



- the number under the element name is the molar mass (more on that later)

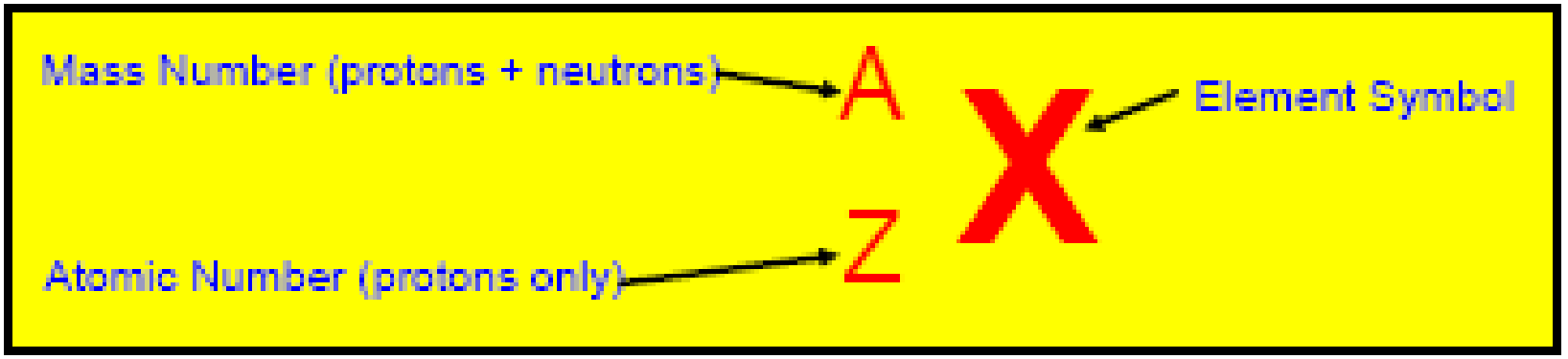
- the Science 10 table also lists the possible ions that each element can form.

Mass Number (atomic mass)

All particles (p, e-, n) make up the atom's mass. But because the mass of an electron is so small compared to that of a proton (about 1/2000th), we ignore it.

Therefore, to determine the mass number of an atom, add the number of protons and neutrons.

We often notate this using the following symbol:



ex) Carbon-12

$^{12}_{6}C$

- most abundant form of carbon
- 6 protons, 6 neutrons

ex) Carbon-14

$^{14}_{6}C$

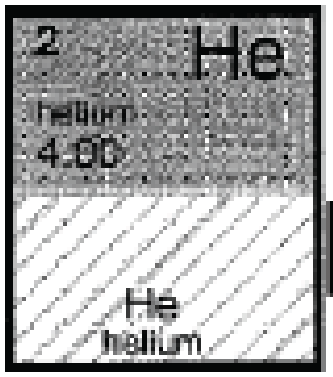
- occurs naturally, but in small amounts
- 6 protons, 8 neutrons

Atoms (like carbon-14) that have a different number of neutrons than protons are called isotopes.

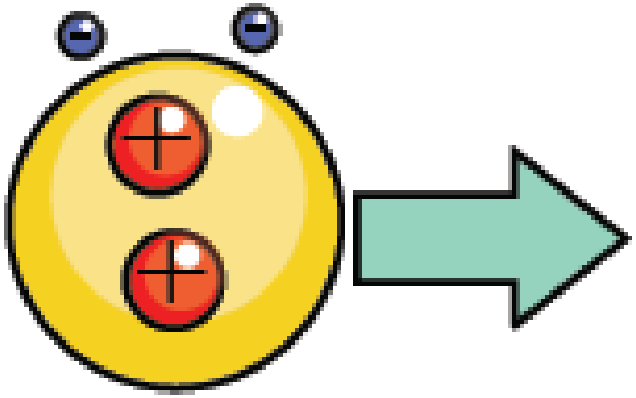
U - Uranium

Most atoms have a few different isotopes (U-238, U-235), some have up to ten (Sn, tin) and 26 have no isotopes (Al, aluminium).

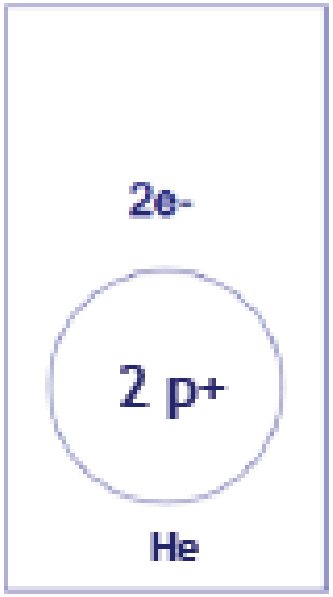
One way to draw a simple diagram of an element that shows it's protons and electrons is by using an electron orbital diagram.



atomic number = 2, therefore helium has 2 protons and 2 electrons



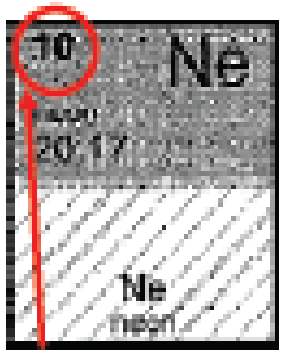
pictorial diagram



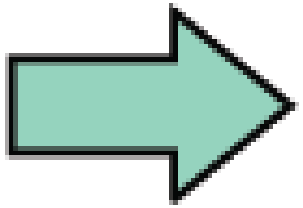
electron orbital diagram

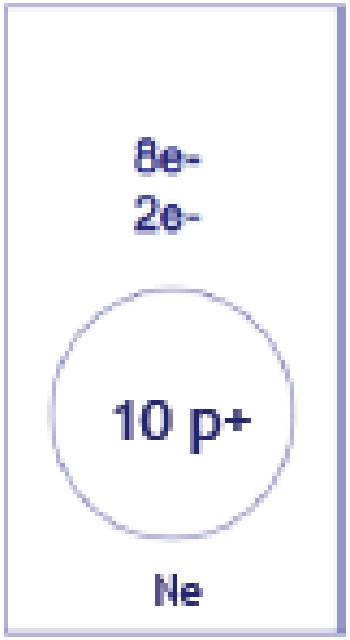
Notice, $He_{(g)}$ has two electrons in its orbital.

Let's look at another noble gas: neon (Ne).



Ne has 10 protons and electrons.

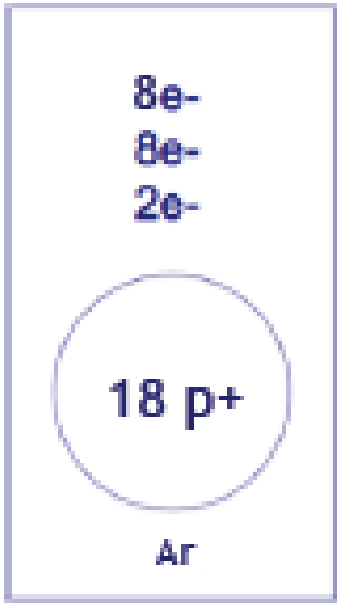




Ne has two electron orbitals: the first has 2 e-'s, the second has 8 e-'s.

The outer orbital in an atom is called the valence orbital.

This is where all the magic is going to happen.



Ar has three orbitals. Notice a pattern starting to form...

Electrons fill the orbitals in a set pattern:

1st Level: 2e-
2nd Level: 8e-
3rd Level: 8e-
4th Level: 2e-

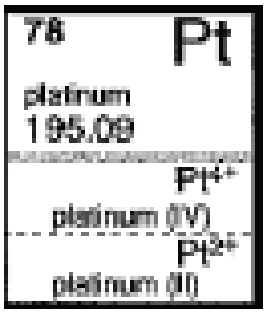
***Note: this only holds for the first 20 elements.**

Ions

By now, you've probably noticed that some elements can also form ions. An ion is an element that has gained or lost electrons to become more stable.

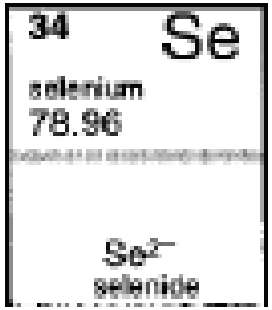
Francium can lose one electron to become a positive ion.

(Fr is radioactive and explodes in water)



Platinum can lose 4 or 2 electrons and can form 2 different ions.

(Pt is the world's mostexpensive metal, $1600 CAD per ounce)



Selenium can gain 2 electrons to form a negative ion.

(Se is the active ingredient in dandruff shampoos)

Positive ions are called cations.

I remember this because I like cats, cats are good and that's a positive thing.

positive

Wizard, Mr. O and Ms. B's cat.

Negative ions are called anions.

I remember this because "anions" sounds kind of like "onions" and no one likes onions, onions are bad and that's a negative thing.

negative