

## Periodic Trends

### Periodic trend

- ~noting a property that is regularly repeating.
- Like noting all elements in group 18 are gases.
- Or metals in group 11 don't readily rust.

### How to tell what is more reactive

- Most reactive metals are down and to the left (most metallic)
- Most active metal is Fr then Cs then Ra
- Most reactive nonmetals are up and to the right, excluding the noble gases
- most active nonmetal is F then O then Cl
- As you move towards the center of the table elements become less active.

### Least Reactive Elements

- Least Active elements are the Noble Gases
- Far right column of periodic table (group 18)
- They are also called the inert gases

### What causes reactivity of elements

- All atoms want to have a completely full valence shell (normally 8 electrons).
- For the moment we will only concentrate on main group elements
- Noble gases are already full.
- Elements that are really close, desperately want to get there (halogens and alkali), and tend to be the most reactive.

### Gaining electrons

- metals lose electrons, nonmetals gain electrons and metalloids can go either way is a loose rule.
- Obviously the quickest way for something that has more than 4 electrons to get to 8 is to gain electrons (through chemical bonds).
- halogens want to gain 1, oxygen group wants to gain 2, nitrogen group wants to gain 3.

### Losing Electrons

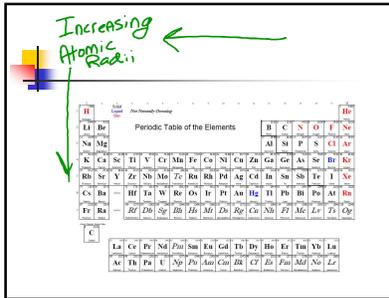
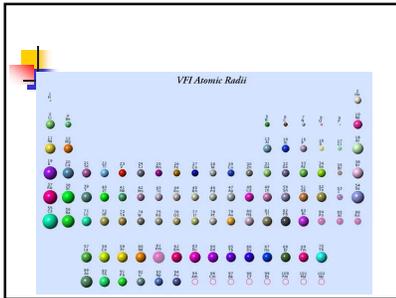
- Metals will gain a full valence shell by losing electrons.
- (there is a full shell underneath unless it is hydrogen)
- alkali will lose 1 electron, alkaline earth will lose 2 etc.

### Atomic Radii

- atomic radius- how big an atom is (radius- distance from center of atom to edge)
- As you add an energy level it gets bigger
- As you add more protons (higher atomic #), there is more attractive force so it gets smaller
- Energy levels have a greater effect than protons

### Largest and smallest

- So start big get smaller across a period, then get bigger as you drop down a period
- The element with the smallest atom is...
- helium
- The element with the largest atom is
- francium



### Ionization Energy

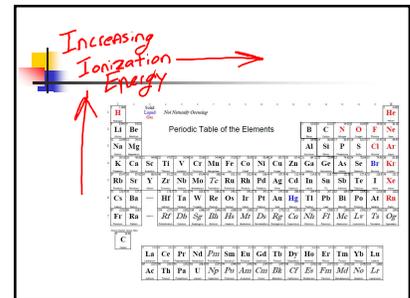
- Ion- atom (or molecule) with a charge
- Ions are created when you add or remove electrons (protons can't be added or removed)
- Ionization Energy- the energy required to remove an electron from an atom

### Ionization energy levels

- Atoms that want to give electrons have a low ionization energy (metals)
- Atoms that want to take electrons have a high ionization energy (nonmetals)
- The noble gases have an even higher ionization energy

### Trends in ionization energy

- As you move from left to right
- Elements have a higher ionization energy
- As you move down
- Elements have a lower ionization energy
- This is because the electrons are further from the nucleus so they are not held as tightly

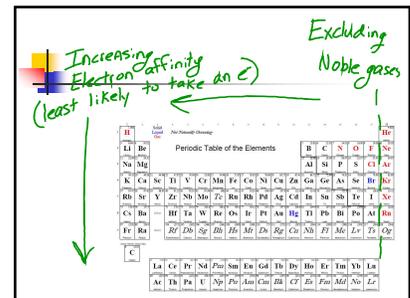


### Electron affinity

- electron affinity- the ability of an atom to attract and hold an electron
- This is measured by the amount of energy that is released when the atom gains an electron
- When energy is released it is a negative number
- This means the lower the number, the more it wants an electron

### Periodic trends in electron affinity

- All noble gases have a positive electron affinity, meaning it takes energy to make an electron stay there
- (just about) Everything else releases energy
- Halogens have the lowest electron affinity (meaning they release the most energy)
- Generally as you go down and to the left it increases



## Organization of the periodic table

- Graphing of all of these trends helped with the modern organization of the periodic table
- When you graph these properties and others (like boiling and melting point) you see similar patterns reoccurring.
- When you put the reoccurring patterns on top of each other you have organized them by our groups

## The graph looks like

