Placement of electrons

Electron's role in reactivity

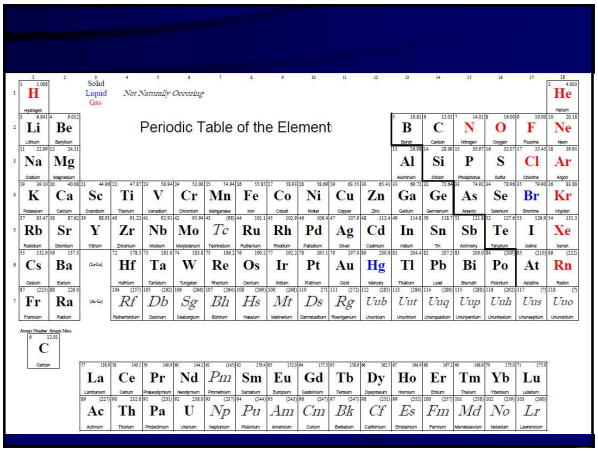
- Chemical bonds are a sharing or transfer of electrons.
- The number and placement of electrons in an atom determine how reactive it is.
- Na (metal) has 11 e^- and is extremely reactive. (explodes in water)
- Na^+ has 10 e^- and is found in table salt (not that reactive)

Electrons are in orbitals at energy levels from the nucleus

- The orbitals are separate shells (like layers) where the electrons are most likely to be found.
- For reactivity, the most important electrons are in the outermost shell.
- Valence electrons- electrons in the outermost shell

Shortcut to determining the number of valence electrons

- Everything in group 1 has 1 valence electron (H, Li, Na, K, Rb, Cs, Fr)
- Everything in group 2 has 2 valence electrons
- Ignore the middle part for now (transition metals and rare earth elements).
- Everything in group 13 has 3 valence electrons.
- Groups 14-18 have 4-8 valence electrons respectively



How to figure out where all the electrons are

- There are 4 types of orbitals s, p, d, and f
- Each shell can hold:
  - s-2
  - p-6
  - d-10
  - f-14
- In the first energy level contains s, the 2nd contains s and p, the 3rd contain s, p and d, the 4th contains s, p, d, and f

Draw out this structure.

- 1 s __
- 2 s __ p __ __ __
- 3 s __ p __ __ __ d __ __ __ __ __
- 4 s __ p __ __ __ d __ __ __ __ __ f __ __ __ __ __ __ __
- 5 s __ p __ __ __ d __ __ __ __ __ f __ __ __ __ __ __ __
- 6 s __ p __ __ __ d __ __ __ __ __
- 7 s __ p __ __ __
- *there are f and d orbitals possible for 6 and 7 but we haven't discovered elements that go up that high.
- electrons are represented by up or down arrows, two arrows per line.

Continuing…

- fill up each orbital before you go to the next orbital
- do all up arrows first all down arrows second
- This is called an *orbital diagram*
- So for Na 11 e^-

•1 s ↑↓

•2 s ↑↓ p ↑↓ ↑↓ ↑↓

•3 s ↑ p __ __ __ d __ __ __ __ __

More…

- Get your electrons the same as you did for the chart (equal to atomic number)
- Each arrow is one electron.
- For Sulfur 16 e^- The electron configuration is $1\ s^2\ 2\ s^2\ p^6\ 3\ s^2\ p^4$

•1 s ↑↓

•2 s ↑↓ p ↑↓ ↑↓ ↑↓

•3 s ↑↓ p ↑↓ ↑ ↑ d __ __ __ __ __

Special rules for filling d and f orbitals

- before you can fill in a "d orbital" you have to fill in the "s orbital" in the energy level above it.
- You must skip an "f orbital" until you have filled in the "s orbital" 2 energy levels above it.

Total order

You are falling backwards!

- 1 s 1
- 2 s 2 p 3
- 3 s 4 p 5 d 7
- 4 s 6 p 8 d 10 f 13
- 5 s 9 p 11 d 14 f 17
- 6 s 12 p 15 d 18
- 7 s 16 p 19