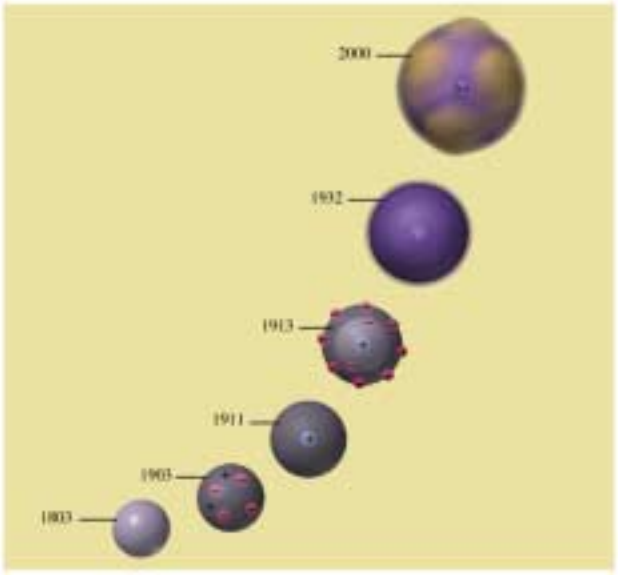
The Atom
Chapter 2

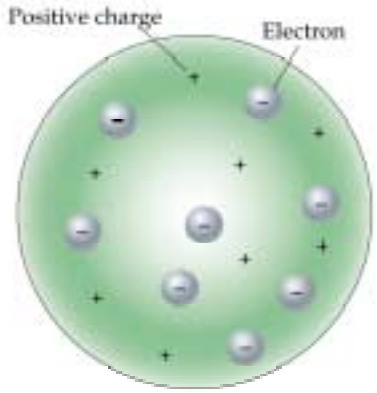
Dalton's Atomic Theory (1803)

- Elements are made up of atoms that are indivisible and indestructible.
- All atoms of an element have the same mass. No two different elements have the same mass.
- Compounds consist of small whole number ratios of elements.
- Elements are not changed during chemical reaction.

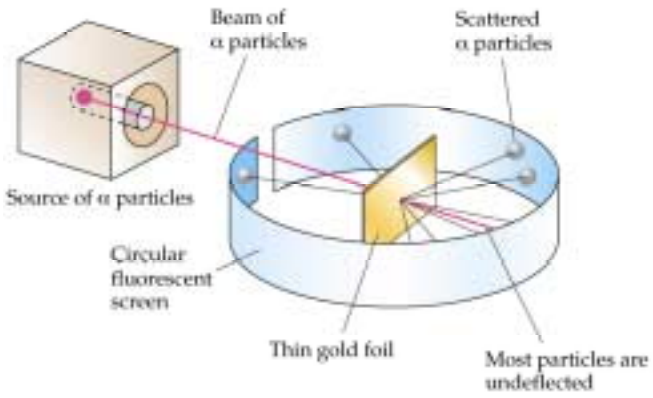
Models of the Atom



1903 Thomson – The plum pudding model



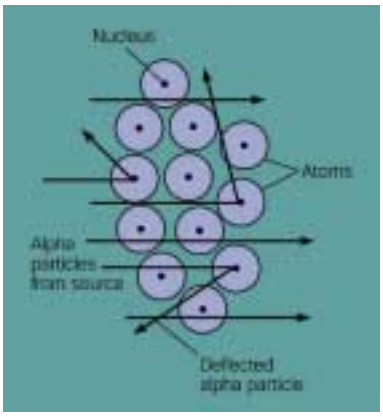
Rutherford's Alpha Scattering Experiment



http://micro.magnet.fsu.edu/electromag/java/rutherford/

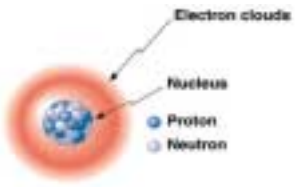
The Results!

Rutherford explained this phenomenon with a revitalized model of the atom in which most of the mass was concentrated into a compact nucleus (holding all of the positive charge), with electrons occupying the bulk of the atom's space and orbiting the nucleus at a distance. With the atom being composed largely of empty space, it was then very easy to construct a scenario where most of the alpha particles passed through the foil, and only the ones that encountered a direct collision with a gold nucleus were deflected or scattered backwards.



Subatomic Particles

Particle	symbol	location	charge	mass
Electron	e-	orbital	-1	1/1836
Proton	p+	nucleus	+1	1
Neutron	n	nucleus	0	1



Describing Individual Atoms

$$\text{Mass Number}\ \text{Atomic number}\ \text{Symbol}^{\text{Charge}}$$

$$\text{protons} + \text{neutrons}\ \text{protons}\ \text{Symbol}^{\text{protons} - \text{electrons}}$$

Example:

$$^{119}_{50}\text{Sn}^{2+}$$

Lets see if you have it!

Fill in the blanks:

Symbol	neutrons	protons	electrons
^{60}Co	**33**	**27**	**27**
^{81}Br^{-}	**46**	**35**	**36**
^{65}Cu^{2+}	36	29	27

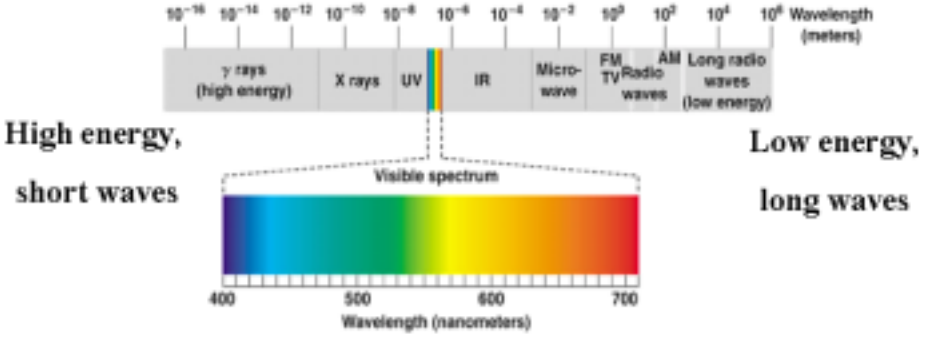
Chlorine (http://scidiv.bcc.ctc.edu/wv/0003-003b-0-isotopes.htm)

- Chlorine is 75% chlorine-35 and 25% chlorine-37. What is the average mass?

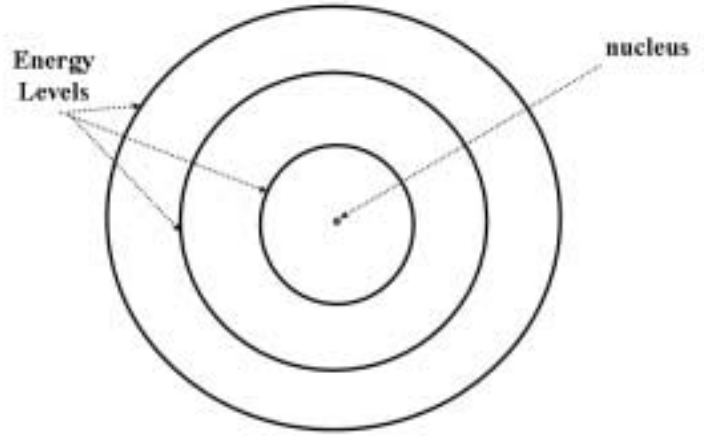
Wave Nature of Light

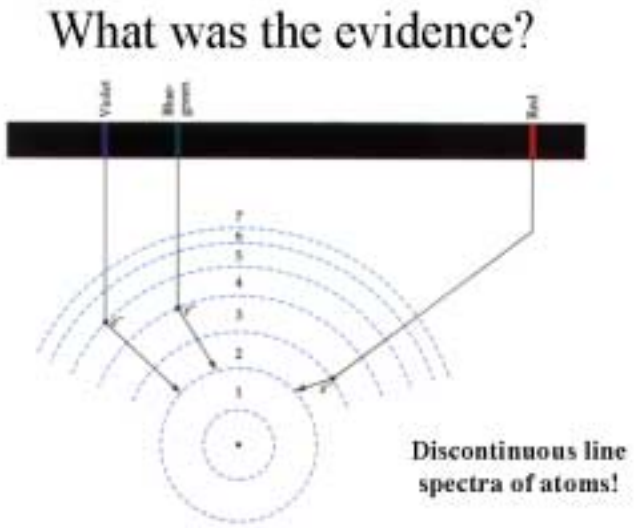
Wavelength – the distance light travels to complete one cycle.
Frequency – the number of wave cycles in one second.

Radiant Energy Spectrum



Bohr Model of Atom (Year: 1913)





Final Statements on the Bohr model (http://www.colorado.edu/physics/2000/quantumzone/bohr.html)

The electron as a wave

http://mooni.fccj.org/~ethall/quantum/quant.htm

- Einstein, "Light, a wave, can have particle like properties"
- De Brolie, "particles, like electrons, can have wave-like properties"
- Scrödinger, "Came up with an equation that describes an electron"

The outcome

- n, principle quantum number. Correlates with shell of Bohr model
- l, subshell. Correlates with type of orbital, s p d or f.
- ml, orientation. px, py or pz.
- s, spin. ↑or ↓

Energy Levels and Subshells

- Each energy level is divided into sublevels, often called subshells.
- Types of subshells: s, p, d, f
- Number of subshells in an energy level depends on the energy level.

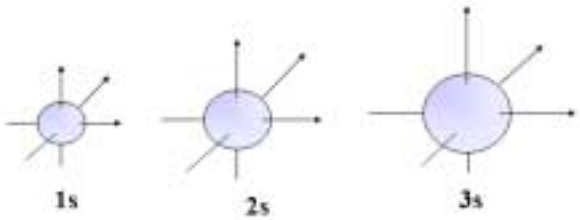
E. Level	**1**	**2**	**3**	**4**
Subshell	**s**	**s,p**	**s,p,d**	**s,p,d,f**

Subshells and Orbitals

- Electrons exist in orbitals.
  - Most probable location for finding an electron.
- The number of orbitals depends on the subshell
- 2 electrons per orbital
- s orbitals come in groups of 1
- p orbitals come in groups of 3
- d orbitals come in groups of 5

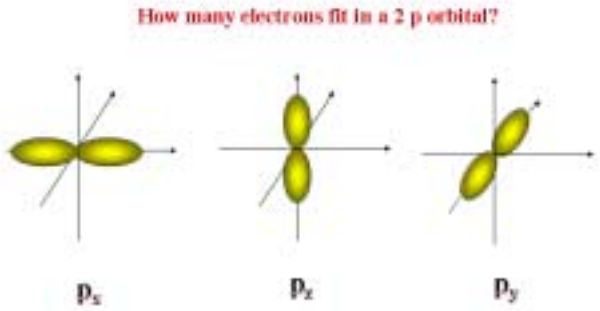
S orbitals

- S orbitals are spherical

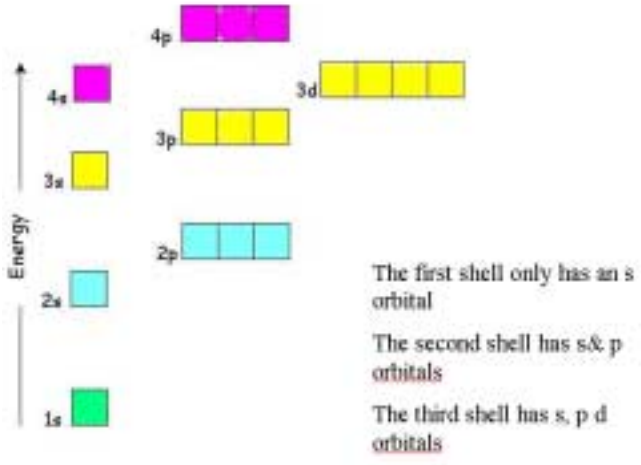


How does a 1s orbital differ from a 3s orbital?

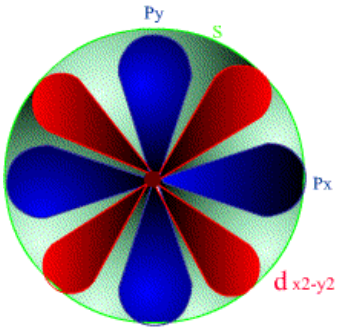
p Orbitals

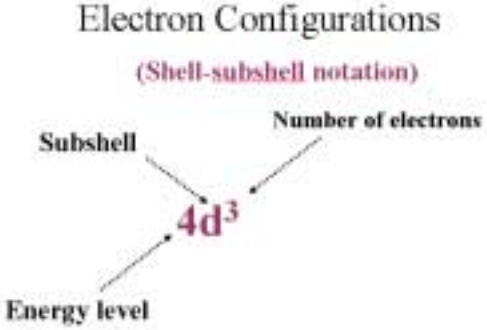


Energy Level Diagram

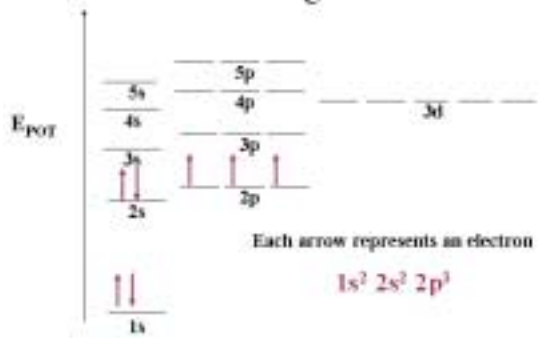


Orbitals in the third shell

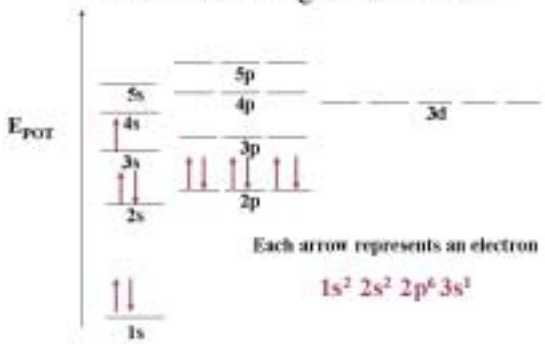




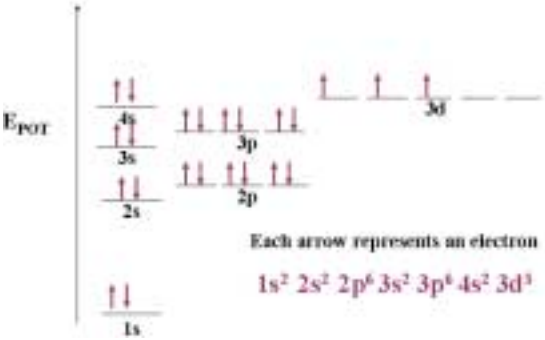
Electron Configuration - N



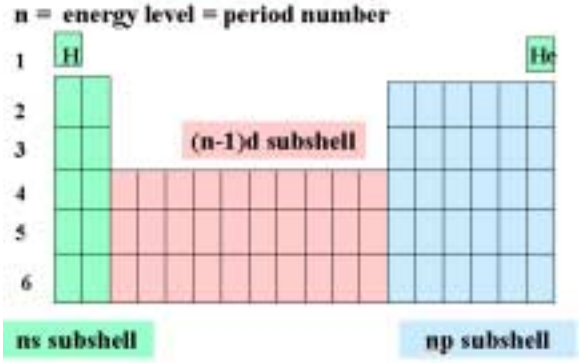
Electron Configuration - Na



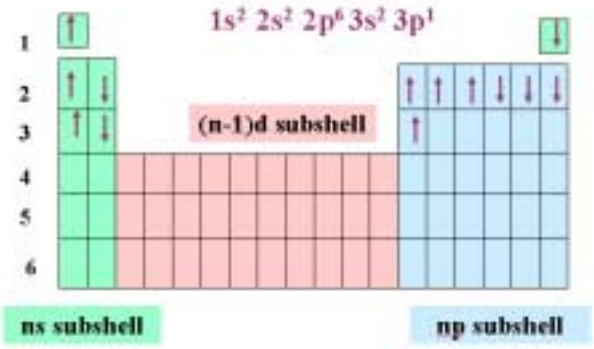
Electron Configuration - V



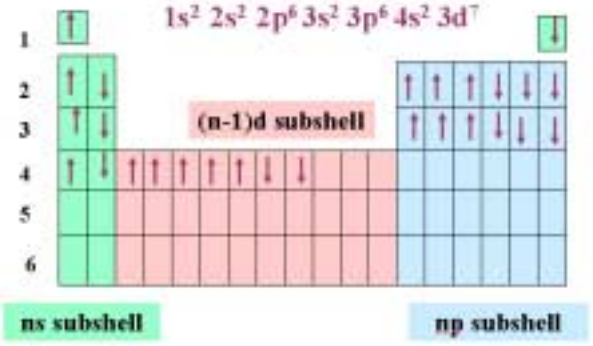
An Easier Way



Electron Configuration – Al



Electron Configuration - Co



Electron Configuration - Sr