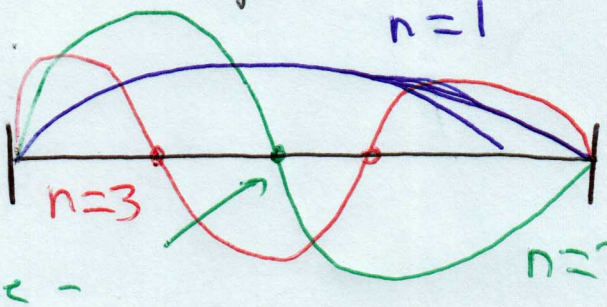
9/28/11

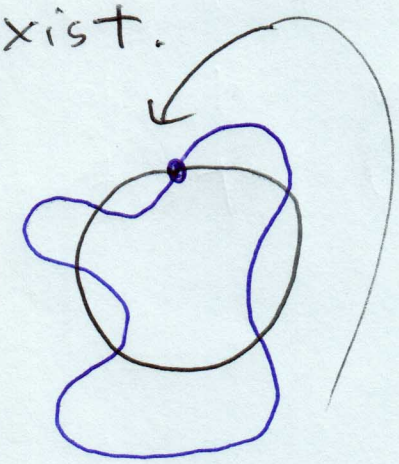
standing waves
quantization
atomic orbitals (nodes + shapes)
electron configurations
valence electrons
isotopes



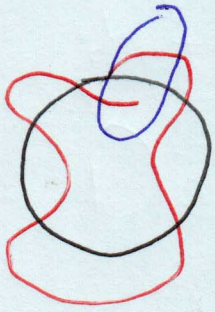
standing wave - a non-propagating wave with one or more fixed endpoints

node - a place on a wave that is immobile (value of the function is 0)

quantization of energy - in a standing wave system, there are only certain waves with certain energy levels ~~can~~ that can exist.



because the wave exactly overlaps itself, it matches the conditions of this ring system.



because the wave does <u>not</u> overlap itself, it will eventually dissipate due to deconstructive interference.

Electrons are described by wavefunctions, which are mathematical representations of the wave behavior of an electron. Wavefunctions are standing waves with the nucleus as a boundary condition → the unique shapes of the wavefunctions are caused by the nucleus. Because wavefunctions act like standing waves, only certain waves can exist.

$$\Psi = R(r)\,Y(\theta,\phi)$$

wavefunction radial spherical

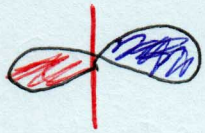
Quantum numbers - represent the different possible wavefunctions in an atom, three of the Q.N. are use to describe an orbital, which is a region in space that an electron is likely to be found.

n = principal quantum number — represents the main energy level — represents the total available packets of energy in an electron,

ℓ = orbital angular momentum — maximum is $n-1$

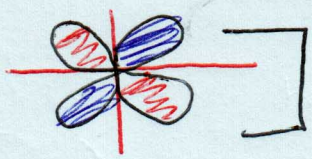
$\ell = 0$

s



$\ell = 1$

p



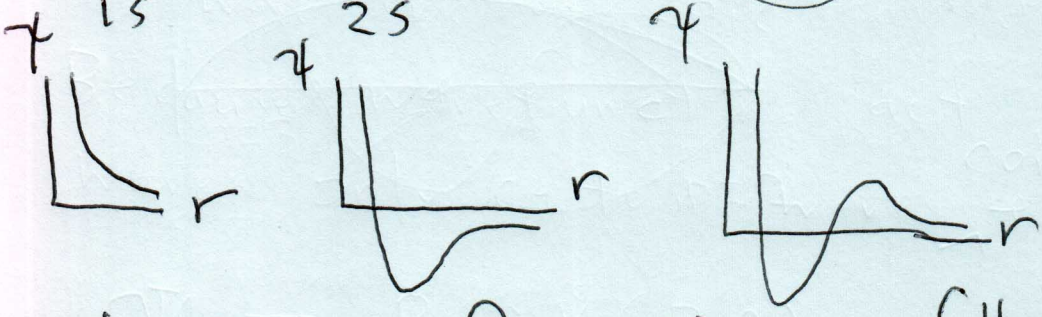
$\ell = 2$

d

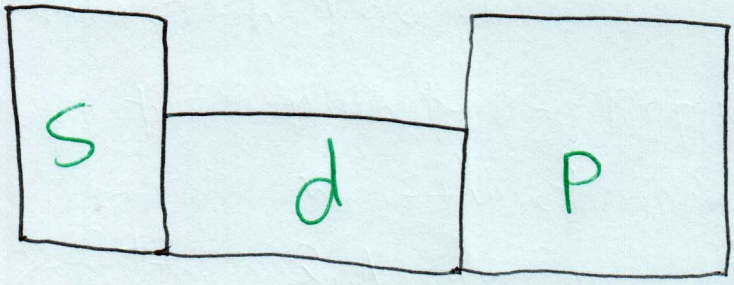
ψ is <0 for one color and $\psi > 0$ for the other

1s

2s



electron configuration



$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6$

octet rule - when the s & p subshells of the outermost shell are filled

shell - energy level (n)

subshell - specific value of ℓ inside a shell

an atom is unusually stable.

Valence electrons - the most-energetic electrons in the outermost shell that participate in bonding.

filling rules

Aufban - lower energy orbitals fill first

Pauli exclusion - two e^- can fit in one orbital

Hund's rule - if there are multiple equal-energy orbitals, each gets an electron before pairing occurs.

#4

F: $1s^2 \boxed{2s^2 2p^5}$

Cl: $1s^2 2s^2 2p^6 \boxed{3s^2 3p^5}$

Br: $1s^2 2s^2 2p^6 3s^2 3p^6 \boxed{4s^2} 3d^{10} \boxed{4p^5}$

These elements all act similarly because they have the same # of valence electrons,

Isotopes— same element, different # of neutrons

$^{1}_{1}H$ $^{2}_{1}H$ $^{3}_{1}H$

H D T

protium deuterium tritium