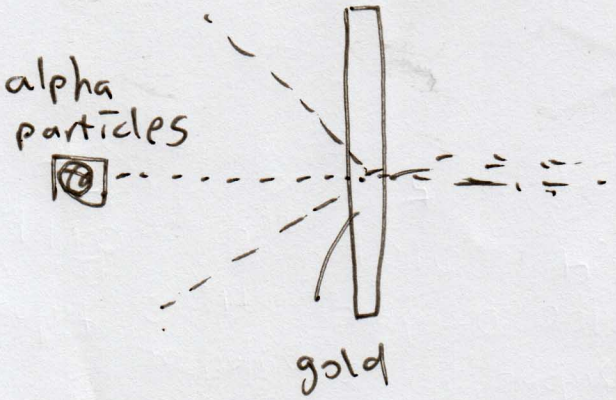
4/16/19

Rutherford Gold Foil experiment



alpha particle = $_2He^{+2}$

ion - a charged particle

cation - a positively-charged ion

anion - a negatively-charged ion

A neutral atom has an equal number of protons and electrons.

In the gold foil experiment, alpha particles were shot into a thin foil of gold. Most of the particles passed straight through, but some alpha particles were deflected back. This was due to the positively-charged alpha particles encountering some positive charge within the atom. The results of this experiment led to the idea that there is a nucleus to the atom.

atomic number (Z) = the number of protons in the nucleus

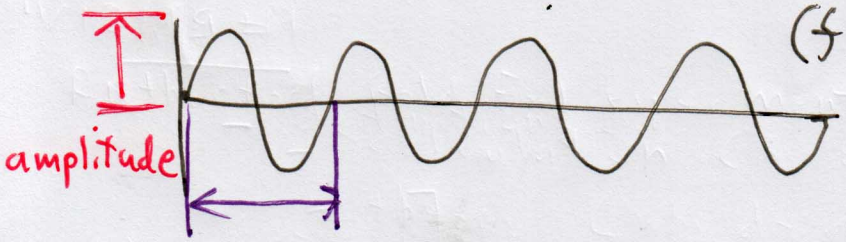
mass number = the total number of protons and neutrons in the nucleus

isotopes - isotopes are atoms with the same atomic number (same # of protons) but different mass numbers (different # of neutrons).

atomic symbol: $_{\text{atomic \# (\# of protons)}}^{\text{mass \# (\# protons + neutrons)}}H^{\text{charge (\# protons - \# electrons)}}_{\text{stoichiometry (\# of atoms)}}$

isotopes of hydrogen

$_1^1H$ protium	$_1^2H$ deuterium	$_1^3H$ tritium
1 proton	1 proton (D)	1 proton
0 neutrons	1 neutron	2 neutrons



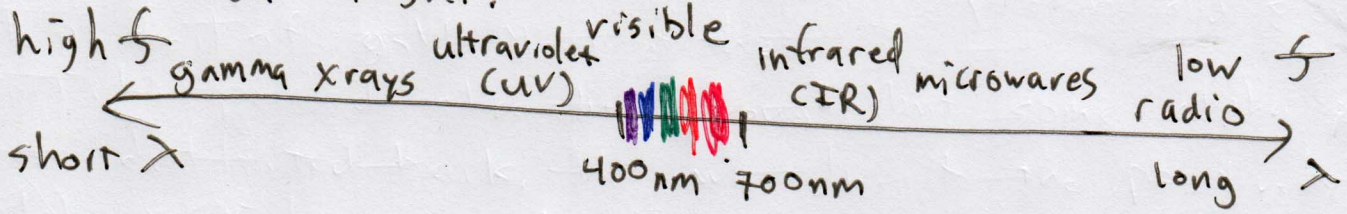
(f) frequency — the number of times a wave oscillates (how many cycles) per second.

1 Hertz (Hz) = $1/s$ or s^{-1}

$\lambda \cdot f = m \cdot 1/s = m/s$ ← same units as speed

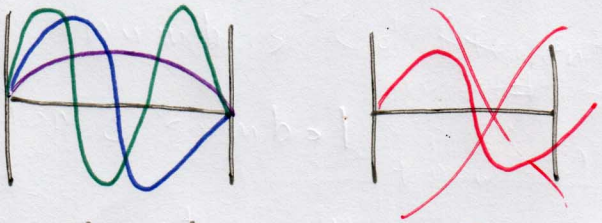
Light has a constant speed (c), so in light, frequency and wavelength are inversely proportional to each other.

spectrum — a range of wavelengths or frequencies of light.



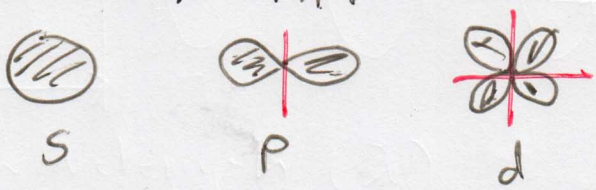
Bohr model of the atom

- The Bohr model of the atom comes from the observation that when atoms are excited, they only give off specific frequencies of light. This was thought to be due to electrons moving between specific energy levels.



- Electrons act both as particles and waves. Because electrons act like standing waves, they can only have specific amounts of energy (quanta), which is why electrons only exist in specific energy levels.

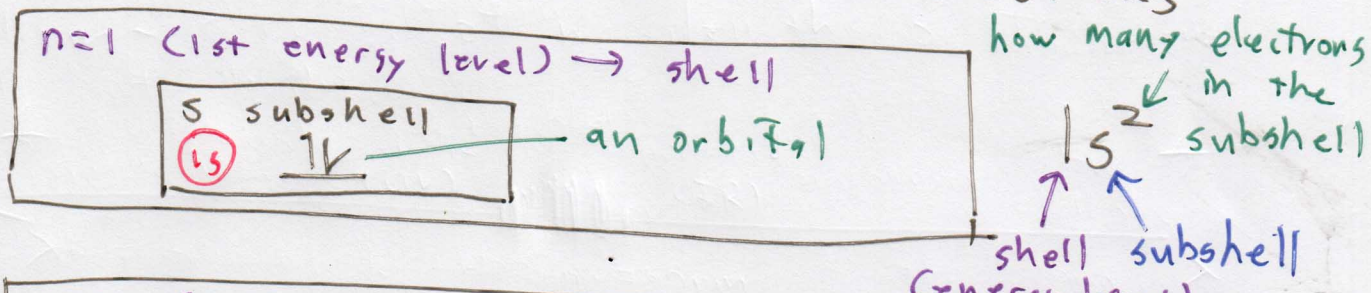
orbital – a specific region in space an electron can exist in.

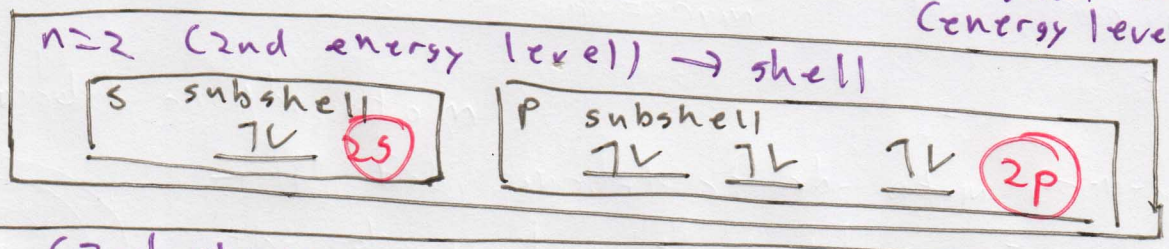


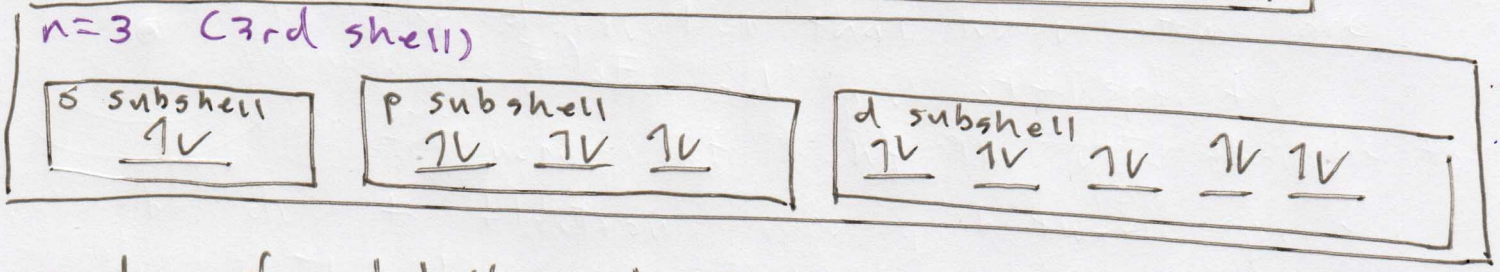
shell – an energy level inside an atom

subshell – a set of orbitals all of the same type (s, p, d...) inside an energy level

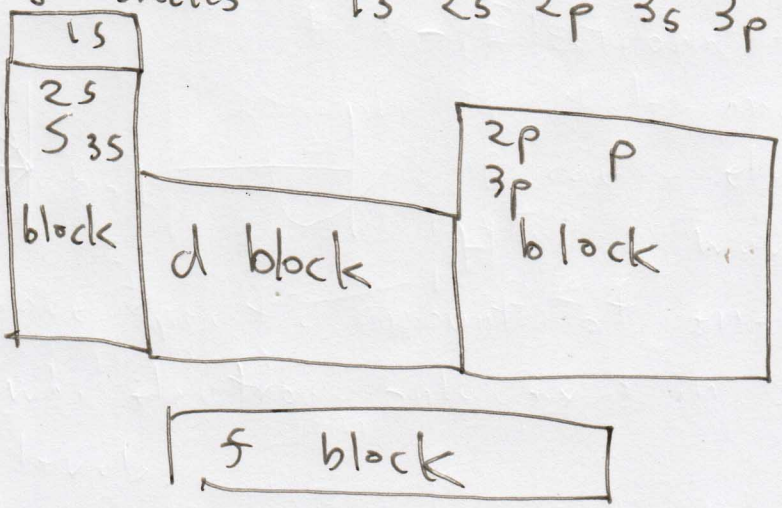
orbital – can hold a maximum of 2 electrons







order of subshells 1s 2s 2p 3s 3p 4s 3d



electron configuration – a list of where electrons are located (in which orbitals)

ground state – the lowest possible energy state for an atom

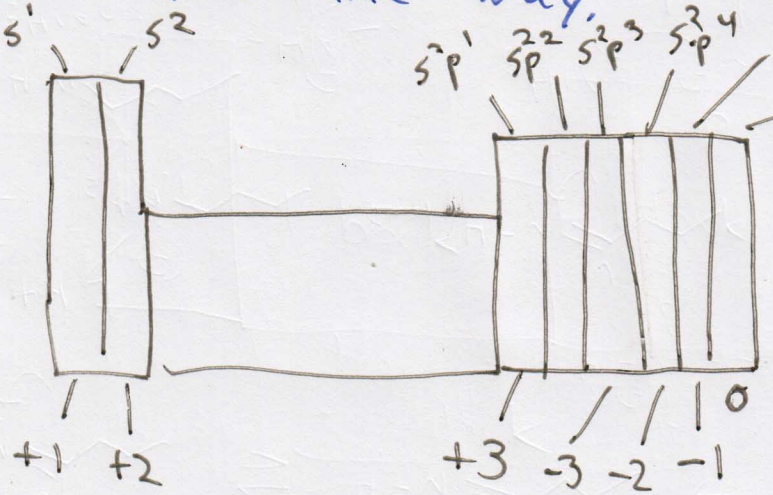
H : $1s^1$
He : $1s^2$
Li : $1s^2 2s^1$
Be : $1s^2 2s^2$
B : $1s^2 2s^2 2p^1$
C : $1s^2 2s^2 2p^2$
N : $1s^2 2s^2 2p^3$
O : $1s^2 2s^2 2p^4$
F : $1s^2 2s^2 2p^5$
Ne : $1s^2 2s^2 2p^6$

octet rule – an atom is unusually stable if it has eight electrons in its outer shell

Na : $1s^2 2s^2 2p^6 3s^1$
Mg : $1s^2 2s^2 2p^6 3s^2$
Al : $1s^2 2s^2 2p^6 3s^2 3p^1$
Si : $1s^2 2s^2 2p^6 3s^2 3p^2$
P : $1s^2 2s^2 2p^6 3s^2 3p^3$
S : $1s^2 2s^2 2p^6 3s^2 3p^4$
Cl : $1s^2 2s^2 2p^6 3s^2 3p^5$
Ar : $1s^2 2s^2 2p^6 3s^2 3p^6$ — octet

valence electrons – electrons in the outermost shell → the highest-energy electrons that will participate in chemical reactions.

Elements with the same valence shell configuration (same number of valence electrons) chemically behave the same way.



group – a set of elements in the same column of the periodic table

Quiz #1

- definitions
- calculation (moles, unit conversions)
- theory (why do atoms only release specific colors of light)

chapter 1 — sections 5 - 9
chapter 2 — sections 1 - 6
chapter 3 — section 4 - 8