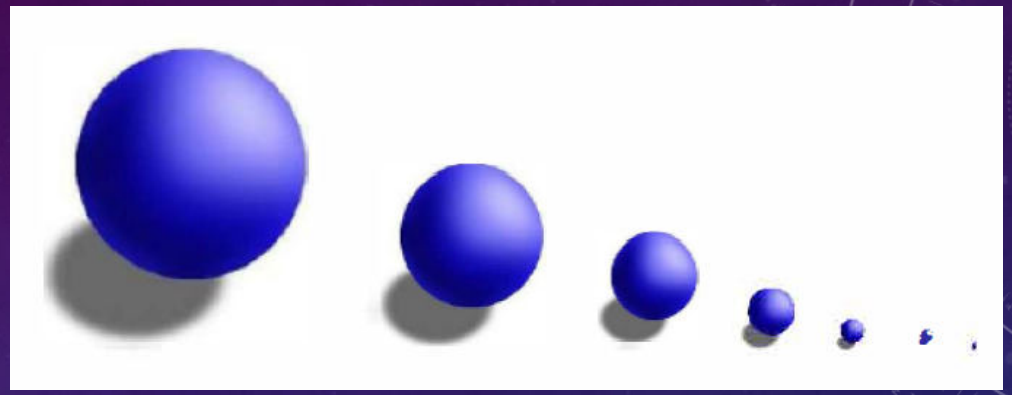
UNIT 3 ATOMIC THEORY

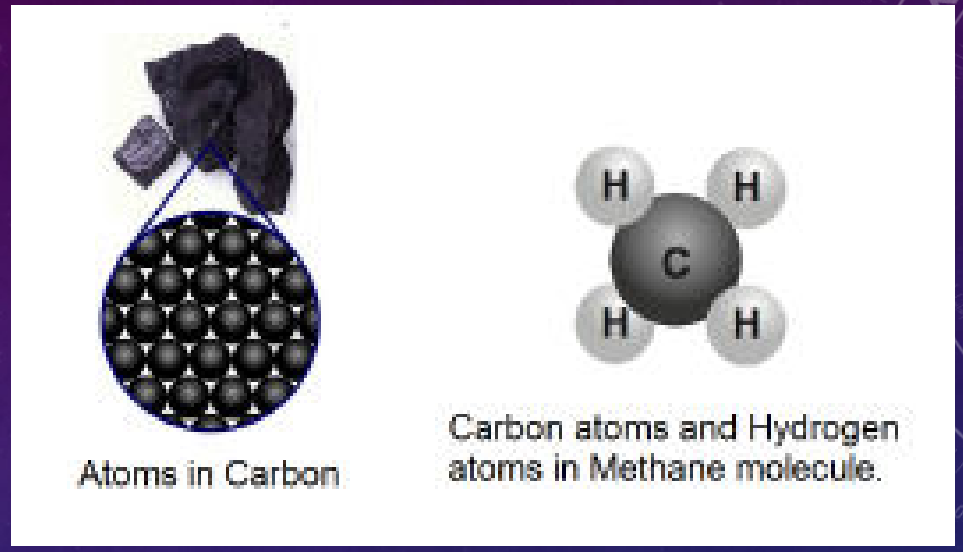
ATOMIC THEORY & STRUCTURE

DEMOCRITUS



Greek Philosopher who theorized that all matter was composed of tiny indivisible particles called atoms (or atomos in Greek, meaning uncuttable). Atoms possess the same chemical and physical properties as the element from which they came.

DALTON

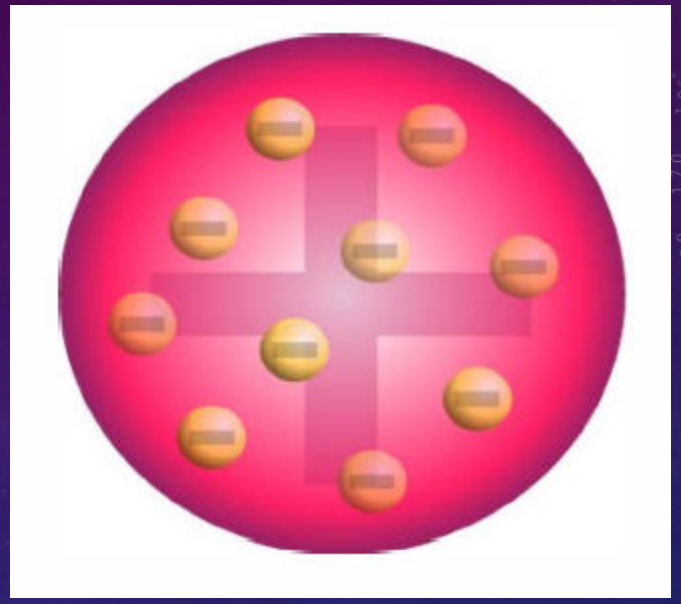


Atoms in Carbon

Carbon atoms and Hydrogen atoms in Methane molecule.

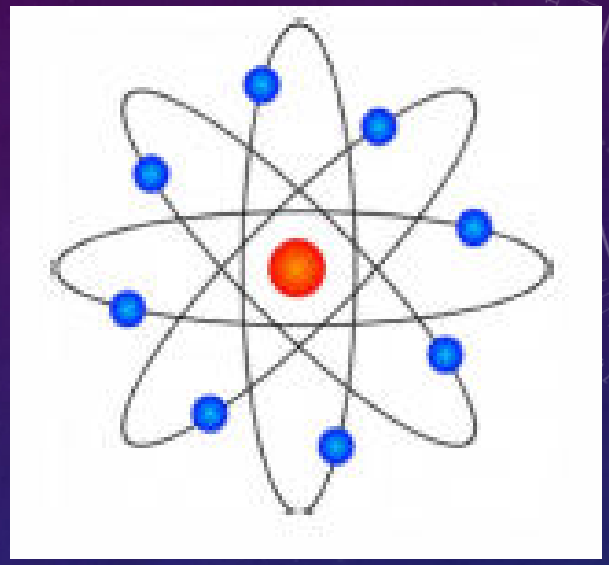
British Schoolteacher who developed the First Atomic Theory of Matter. Dalton *incorrectly* thought that all atoms were identical and indivisible. He *correctly* said that atoms combined to form elements and that elements combined in precise ratios to form compounds.

THOMSON



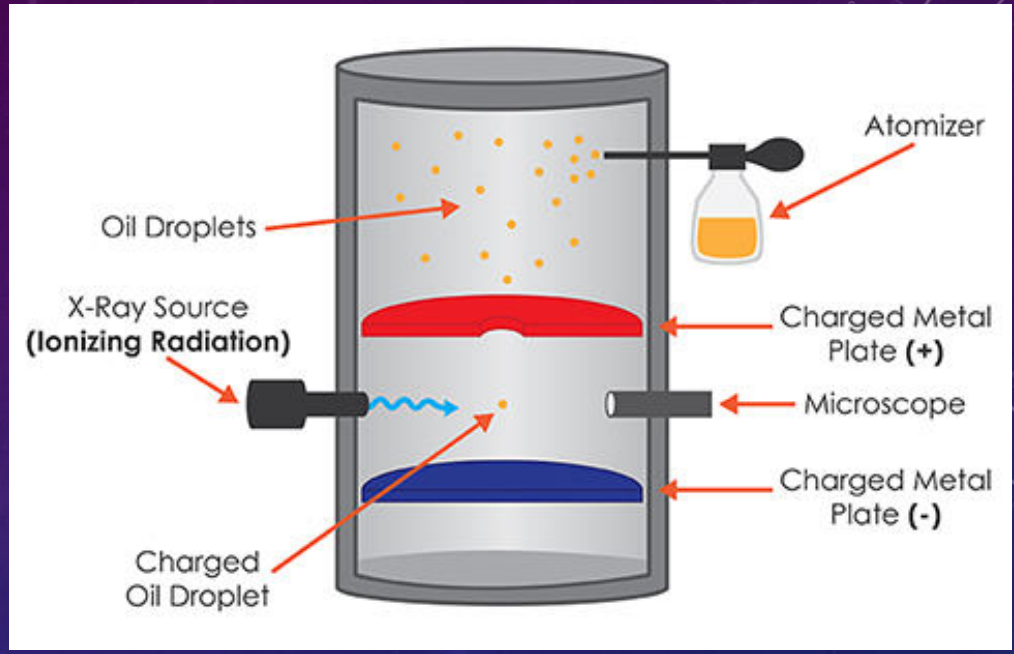
British Physicist who performed the Cathode Ray experiment. He is credited with discovering electrons and said that they were sprinkled randomly throughout the positively charged atom like pieces of plums in Plum Pudding Model.

RUTHERFORD



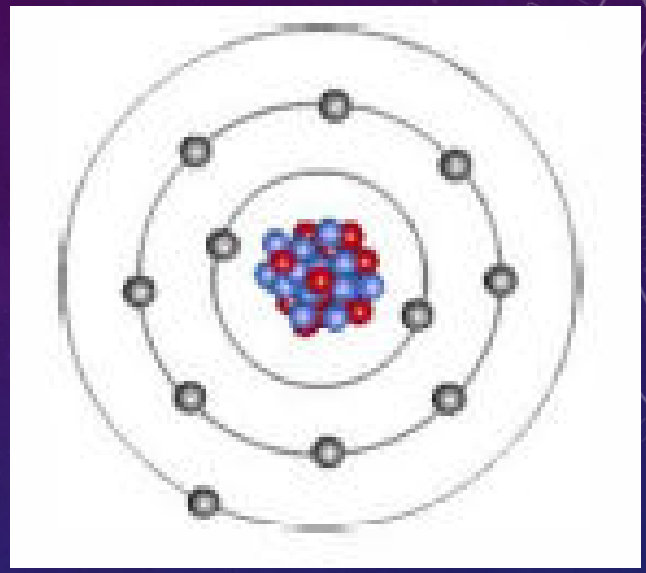
British Physicist who performed the Gold Foil Experiment. This experiment proved that the atom was mostly empty space and that the protons were densely packed in the nucleus.

MILLIKEN



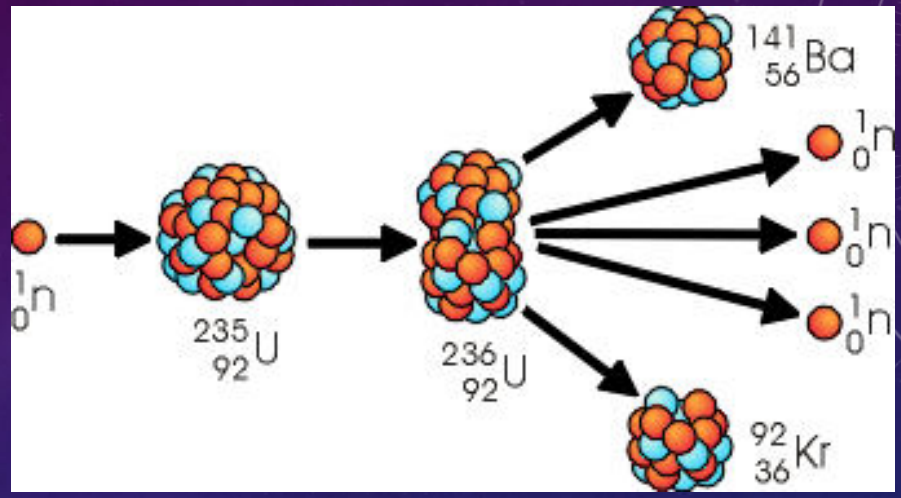
An American physicist, who discovered the charge to mass ratio of the electron in 1910 using the Oil Drop experiment. This information lead to the creation of Mass Spectroscopy.

BOHR



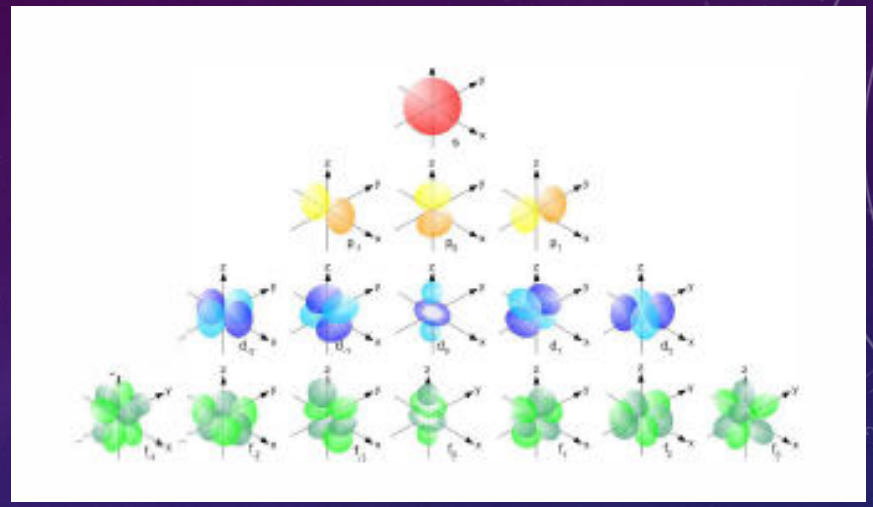
Danish Physicist who suggested that electrons exist in discrete fixed orbitals. Electrons can jump to higher energy orbitals. Electrons emit light when they fall to lower energy orbitals. This is called the Planetary Model.

CHADWICK



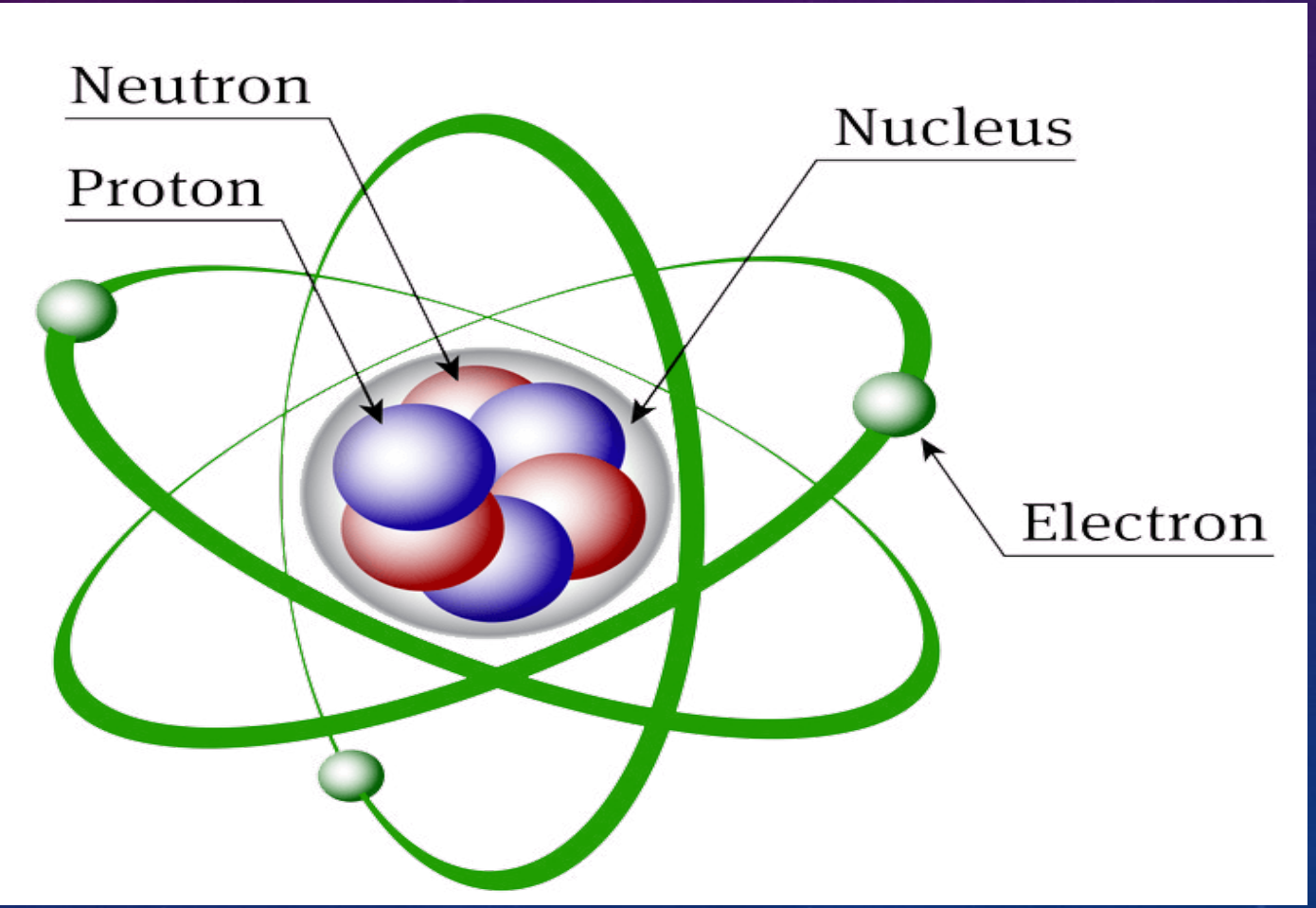
English Physicist who experimented with Fission Reactions. Noticed that neutral particles were emitted from the nucleus, when beryllium was bombarded with alpha particles. He called the neutral particles neutrons.

DE BROGLIE

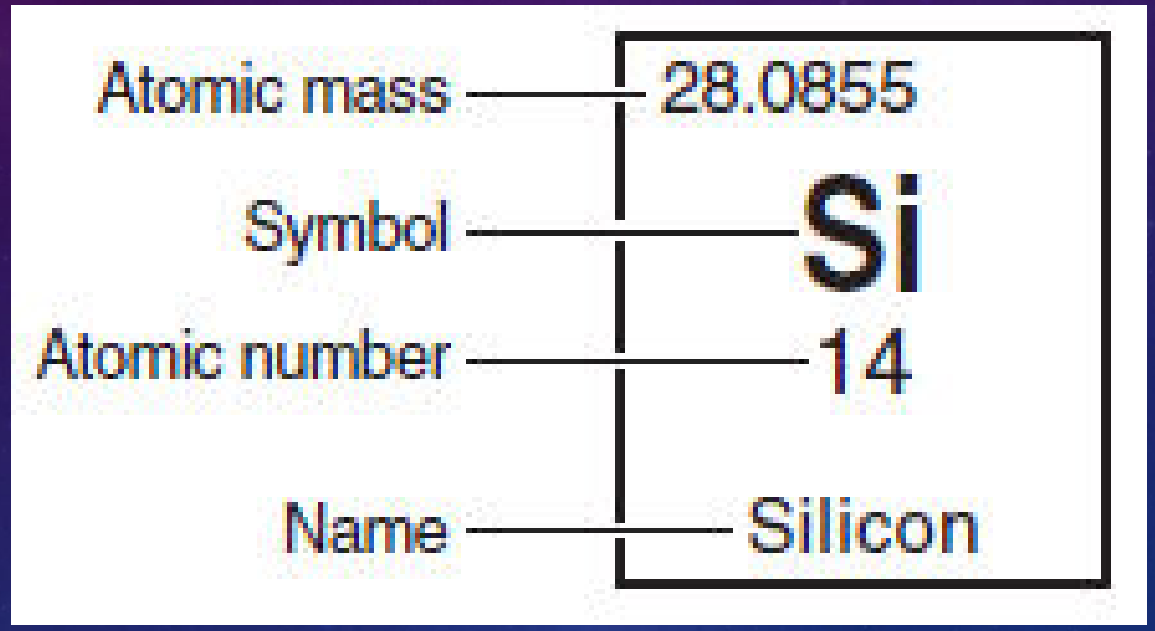


French physicist, who suggested that electrons travel at the speed of light in wave patterns called probability orbitals or probability clouds. These regions have different shapes and suborbitals depending on the amount of energy required.

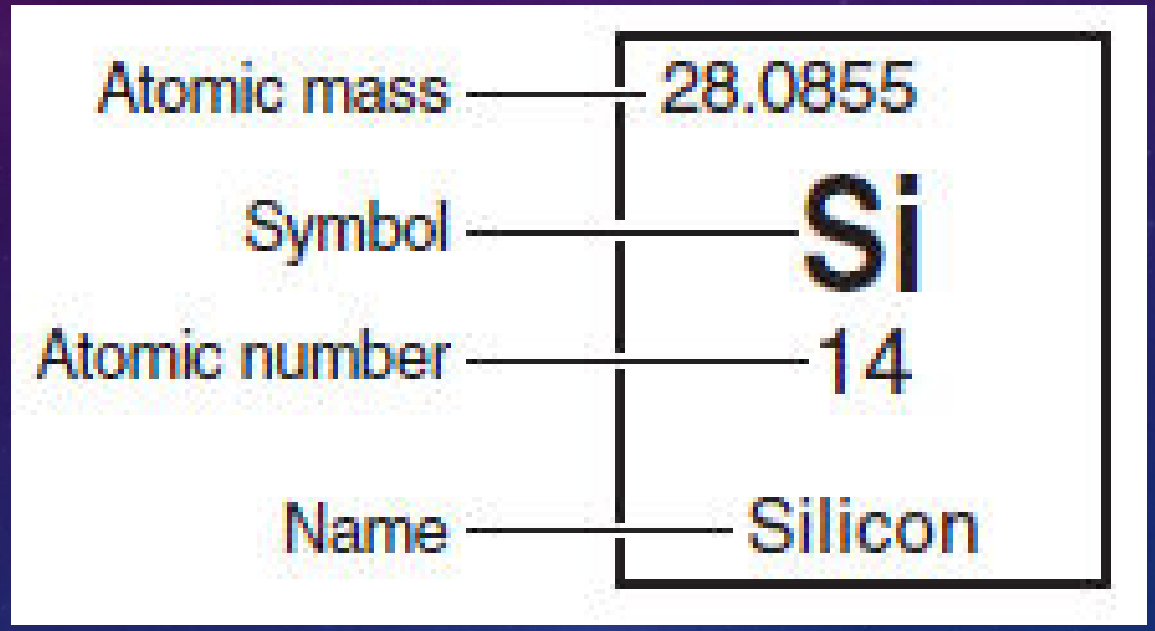
ATOMIC STRUCTURE



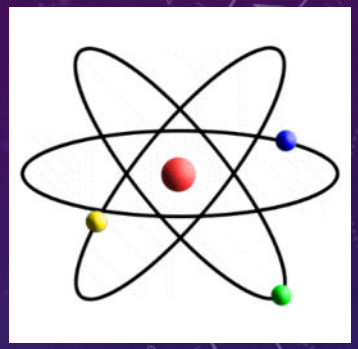
PERIODIC ELEMENTS



PERIODIC ELEMENTS

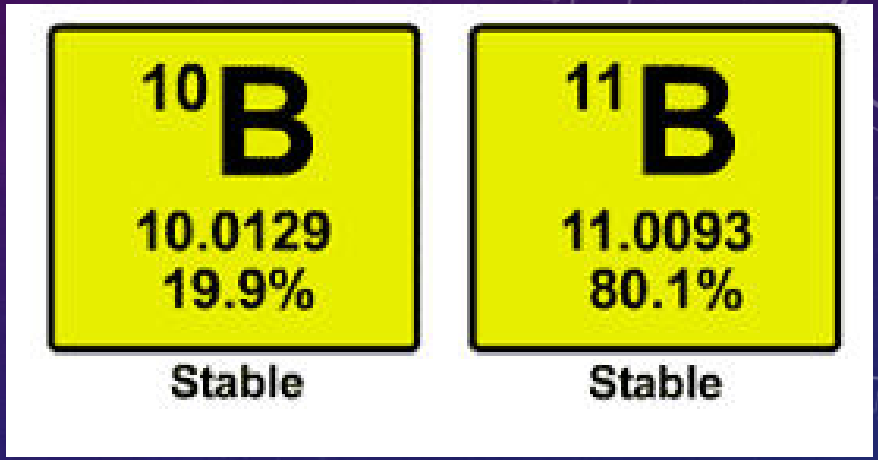


SUBATOMIC PARTICLES



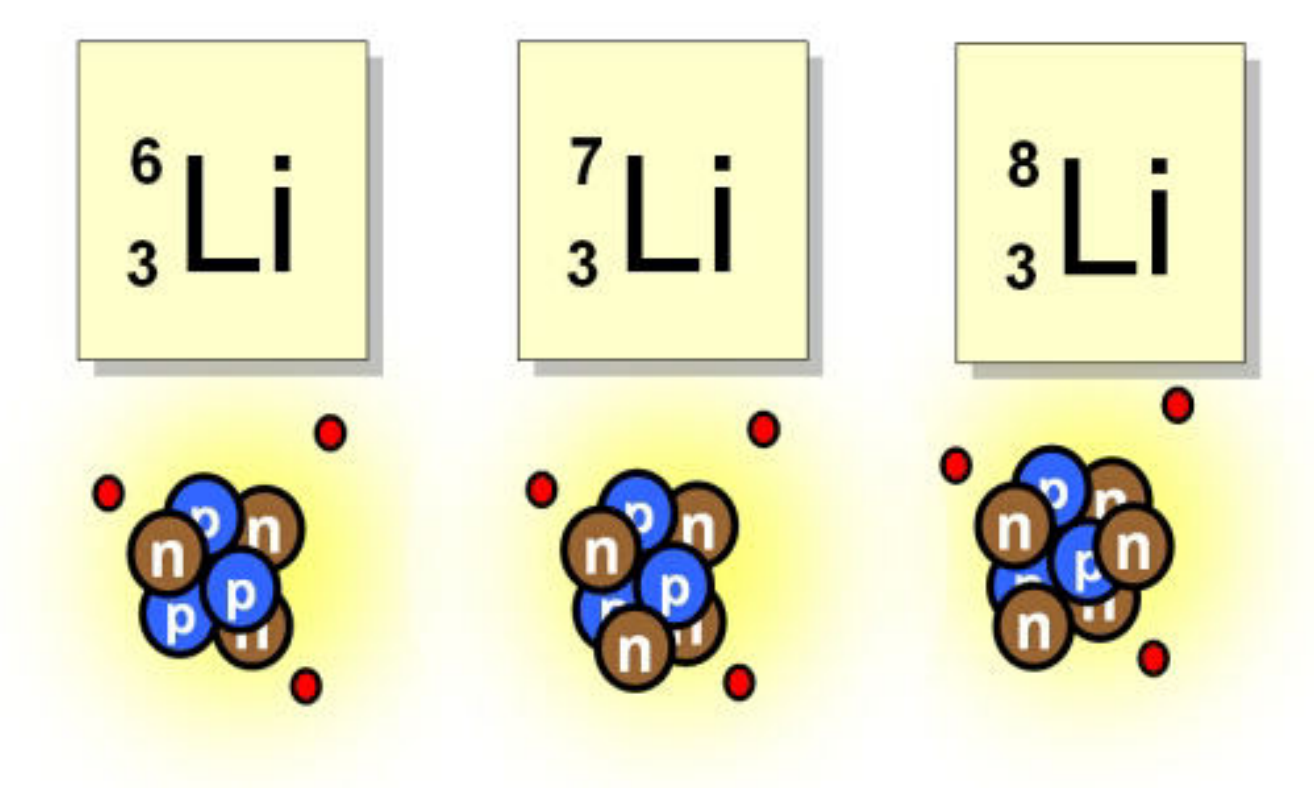
Particle	Charge	Mass	Location
Proton (p^+)	+ charge	1	nucleus
Neutron(n^o)	No charge	1	nucleus
Electron (e^-)	- charge	0	Orbital Cloud

ATOMIC CALCULATIONS



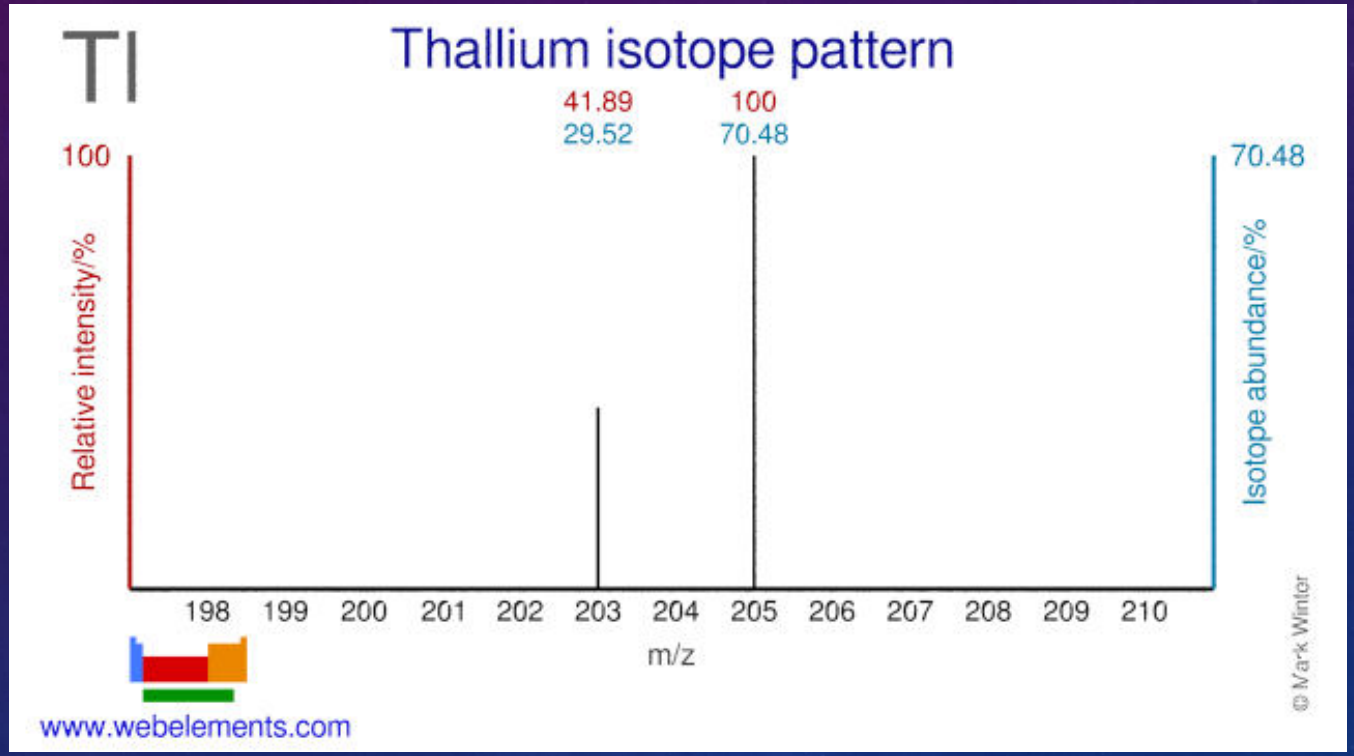
- Mass # = Protons + Neutrons
- Neutrons = Mass # - Protons
- Atomic # = Protons (as shown on periodic table)
- Electrons = Protons (for neutral atoms)
- Average Mass = $\frac{(Mass)(\%) + (Mass)(\%)}{100}$

ISOTOPES



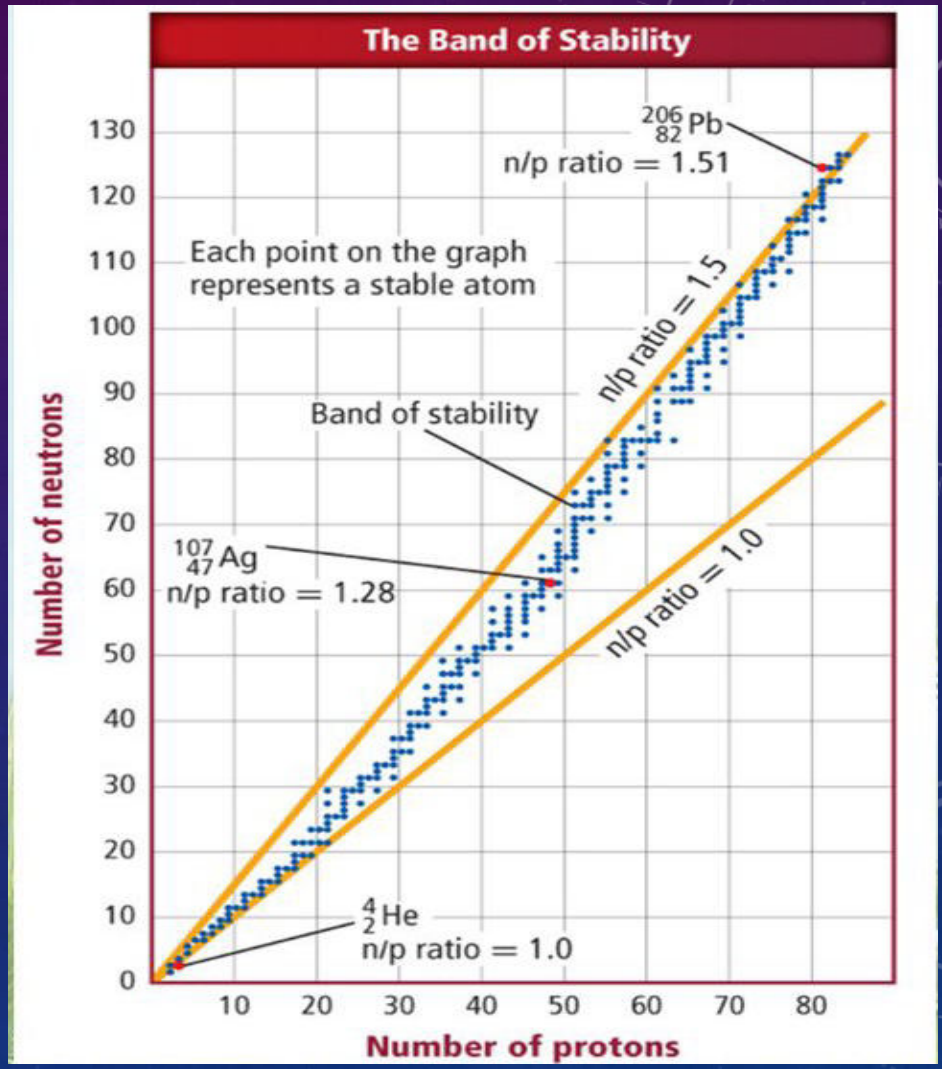
- Same # of protons
- Different # of neutrons
- Different mass number
- Different properties

MASS SPECTROSCOPY



RADIOACTIVITY

- Occurs when the nucleus of a large atoms falls apart
- Emits smaller nuclei and radioactive particles
- Band of stability is based on ratio of neutrons to protons
- Neutrons stabilize atoms by reducing repulsion forces.



NUCLEAR REACTIONS

$$^{226}_{88}Ra \rightarrow {}^{4}_{2}\alpha + \_\_\_\_\_$$

$$^{226}_{88}Ra \rightarrow {}^{0}_{-1}\beta + \_\_\_\_\_$$

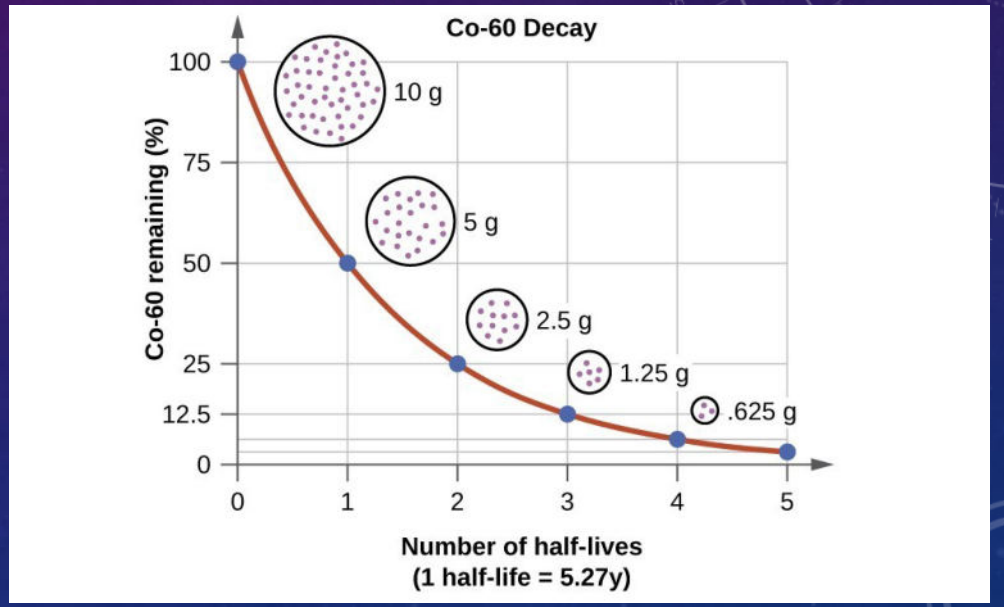
$$^{226}_{88}Ra \rightarrow \_\_\_\_\_ + {}^{226}_{87}Fr$$

HALF- LIFE CALCULATIONS

of decay cycles =

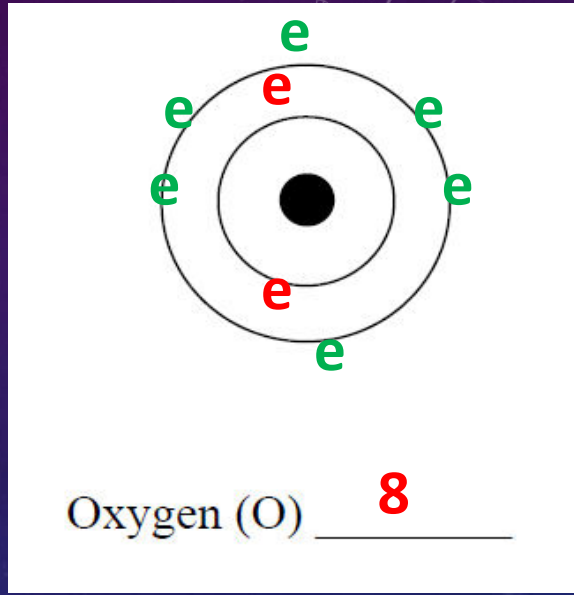
$$\frac{\textit{amount of time passed}}{\textit{length of one half life}}$$

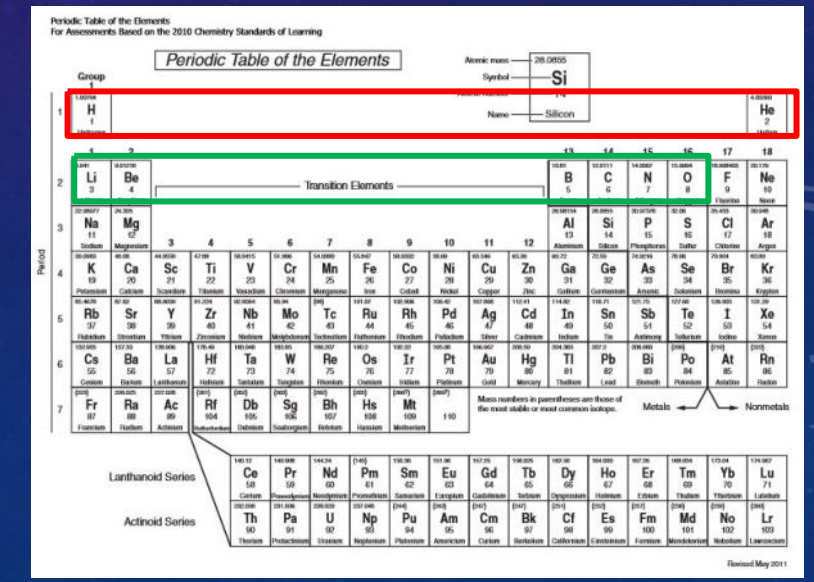
To obtain the **amount remaining** you must **DIVIDE** the starting amount **by 2** for each **decay cycle**.



VALENCE ELECTRONS

- Located on outermost orbital
- Come from the **S** and **P** orbitals
- Determine type of **chemical bonding**
- Determine **physical and chemical properties**
- Most elements follow the **Octet Rule**

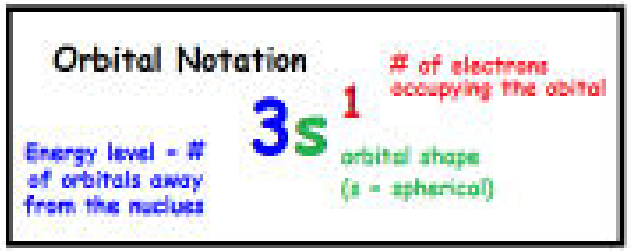


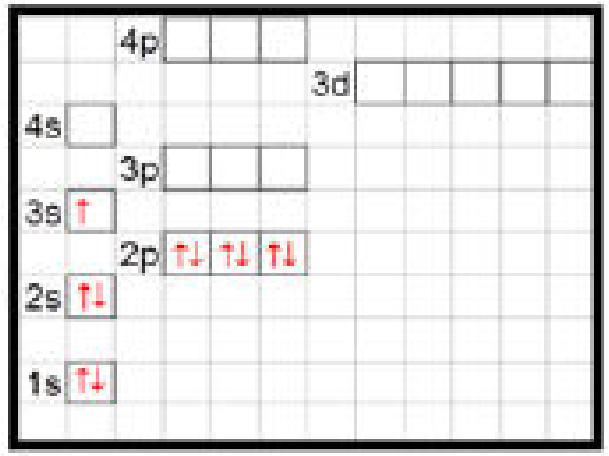


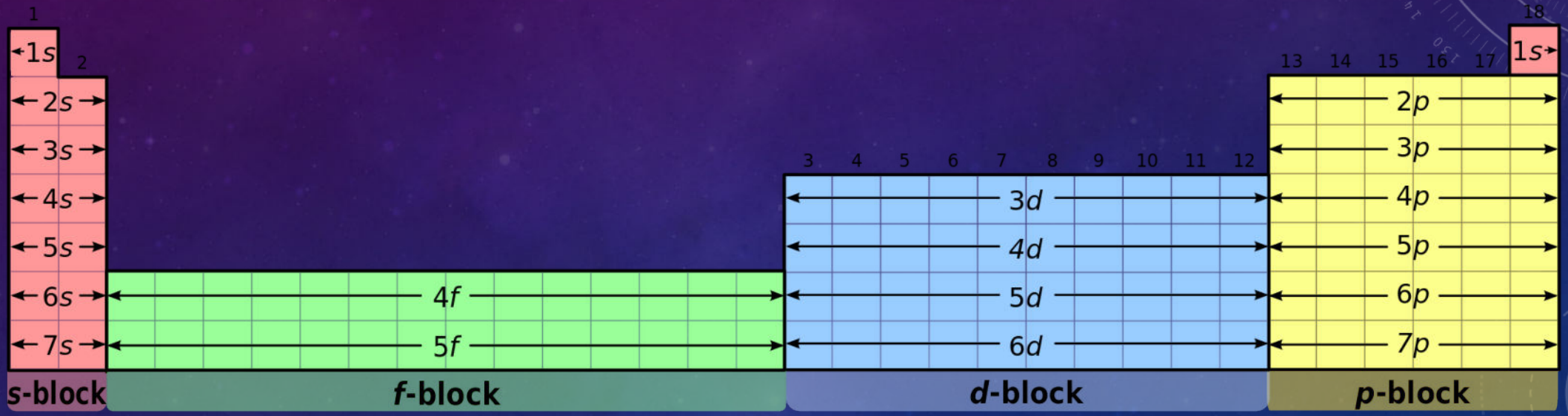
FILLING ORBITALS

How to write an electron configuration:

- Aufbau's Principle – fill the lowest energy level first
- Hund's Rule – each orbital must be filled once before pairing electrons
- Pauli's Principle – paired electrons must have opposite spins



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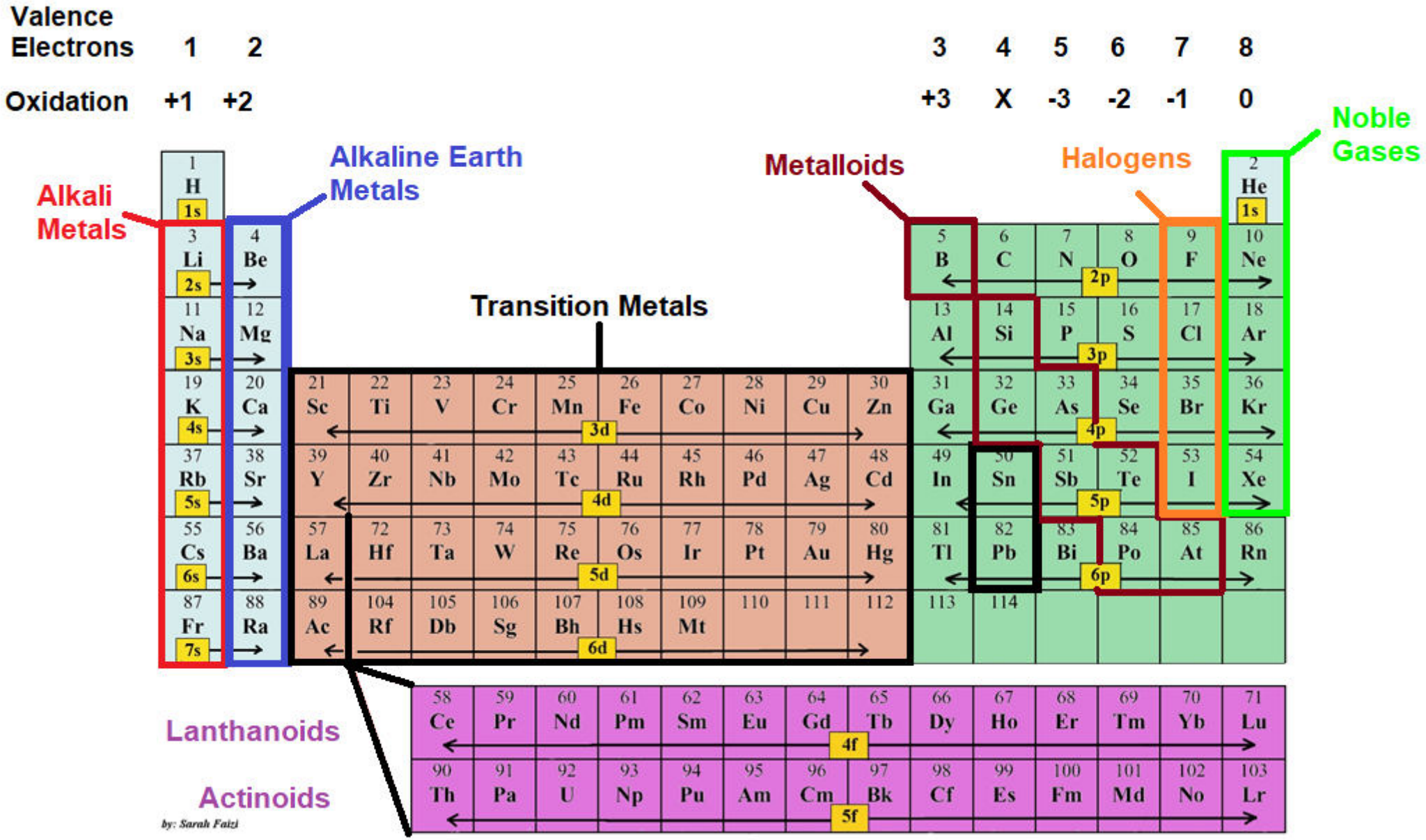
Valence Electrons 1 2 3 4 5 6 7 8
Oxidation +1 +2 +3 X -3 -2 -1 0
Alkali Metals
Alkaline Earth Metals
Transition Metals
Metalloids
Halogens
Noble Gases
Lanthanoids
Actinoids
by: Sarah Faizi