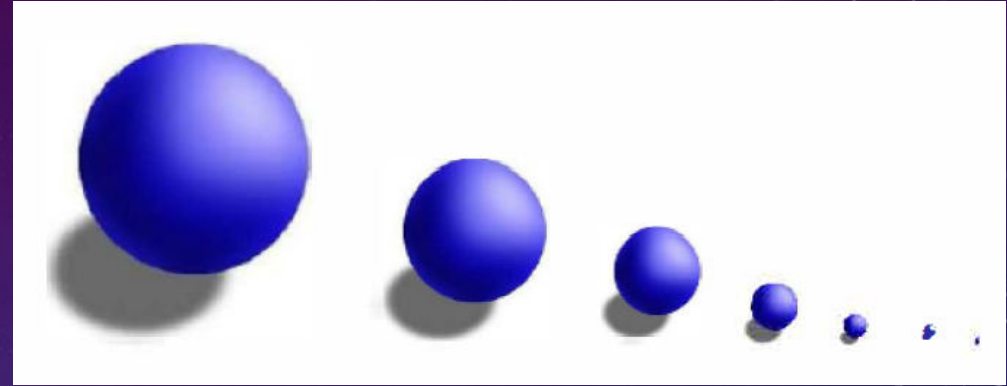


The background is a dark blue gradient with a subtle pattern of white dots. Overlaid on this are several faint, light blue circular and semi-circular patterns. Some of these patterns include tick marks and numbers, resembling a circular scale or a clock face. The numbers visible include 40, 150, 160, 170, 180, 90, 200, 210, 220, 230, 240, 250, and 260. There are also curved arrows indicating a direction of movement or rotation.

# **UNIT 3 ATOMIC THEORY**

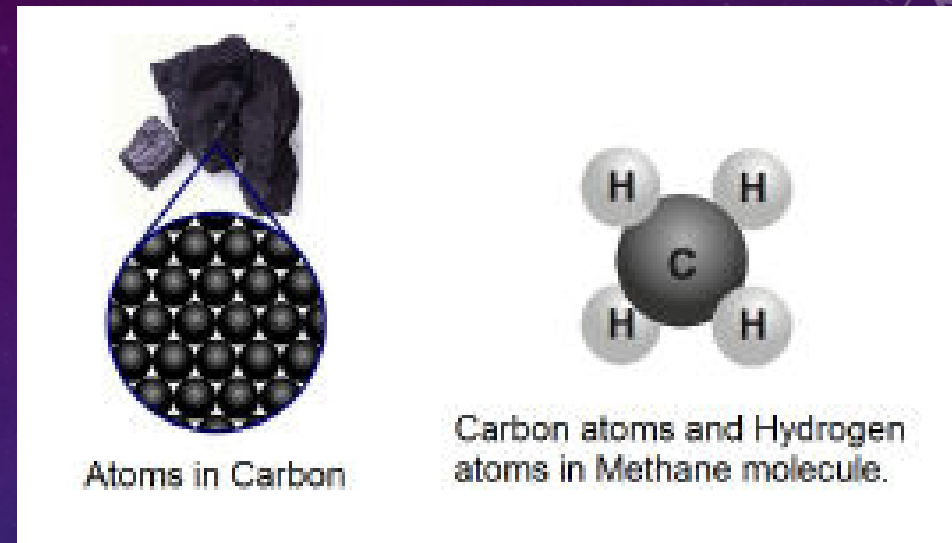
**ATOMIC THEORY & STRUCTURE**

# 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.

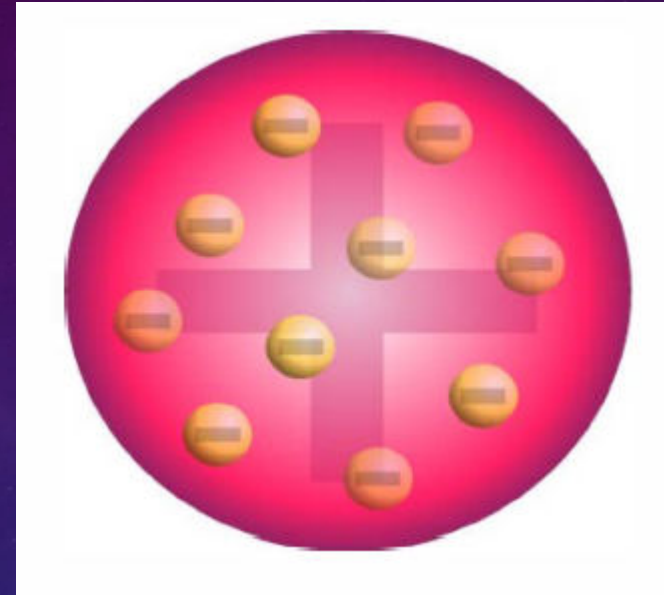
# DALTON



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**.

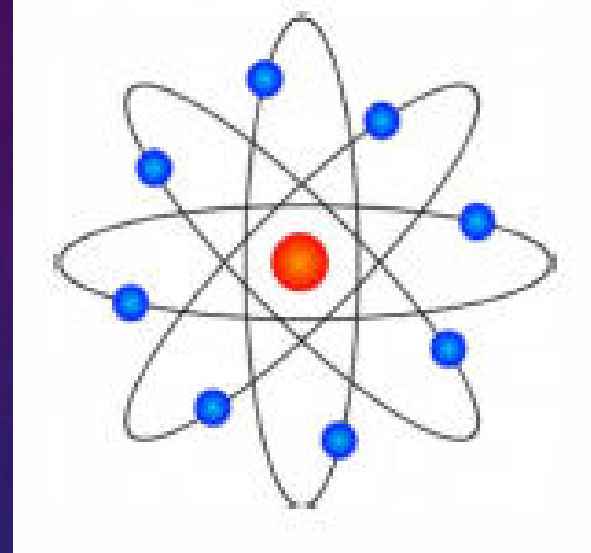


# THOMSON



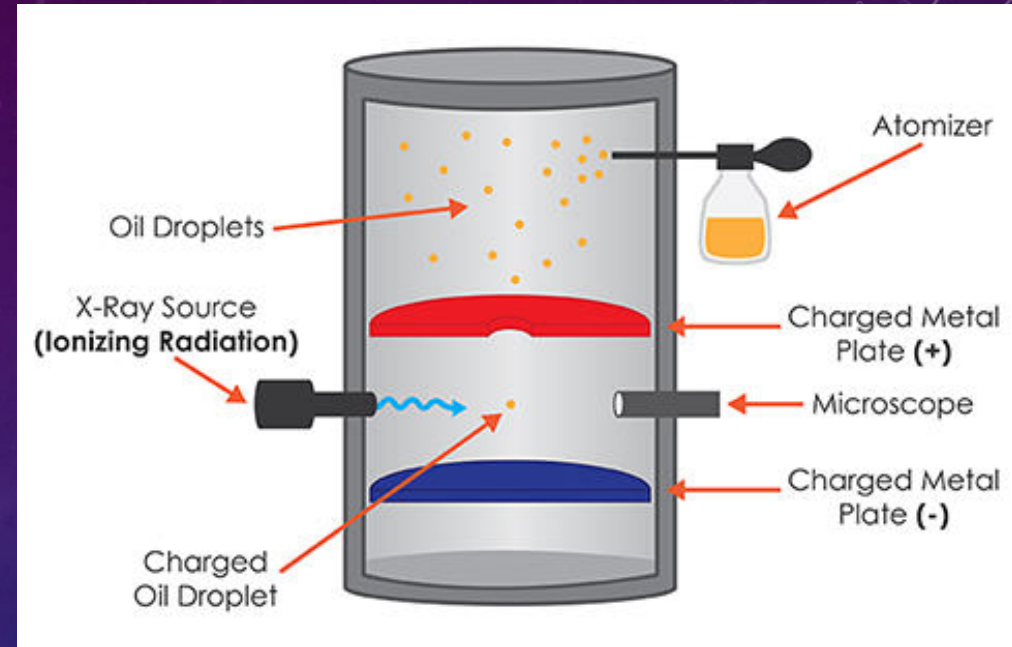
British Physicist who performed the **Cathode Ray experiment**. He is credited with **discovering electrons** and said that they were sprinkled randomly throughout the positively charged atom like pieces of plums in **Plum Pudding Model**.

# 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.

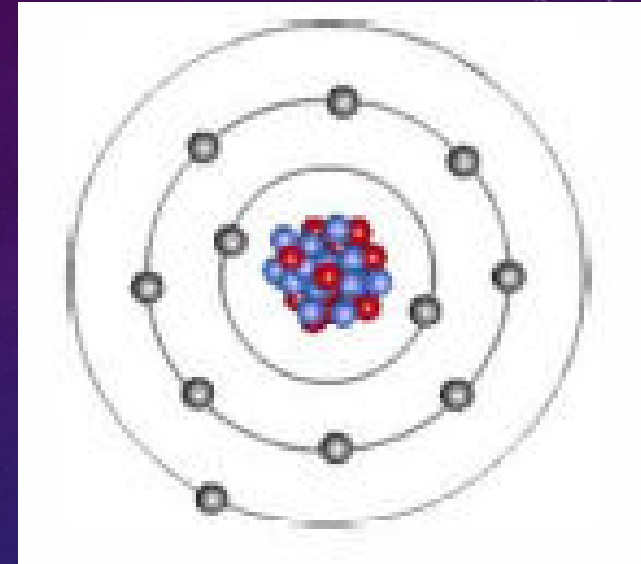
# MILLIKEN



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**.

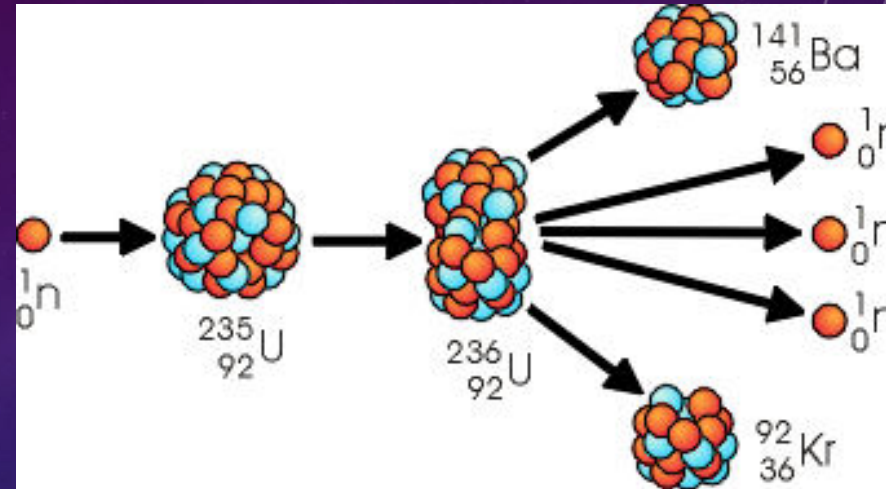


# BOHR



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**.

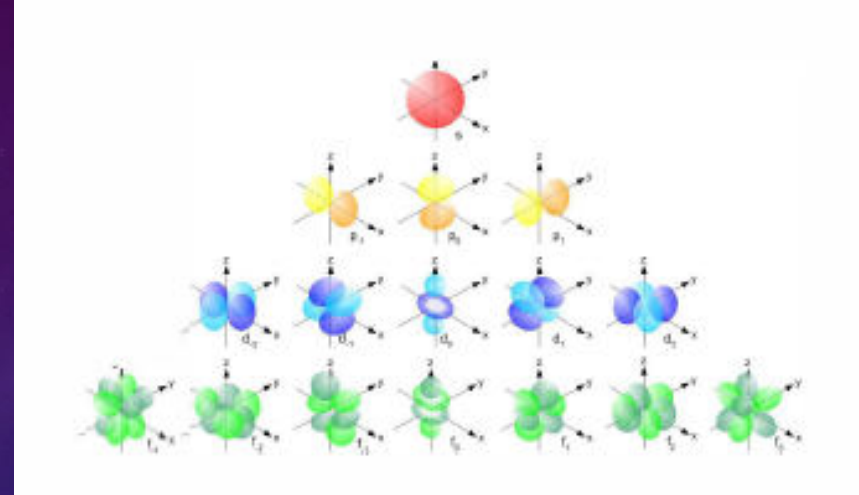
# CHADWICK



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**.

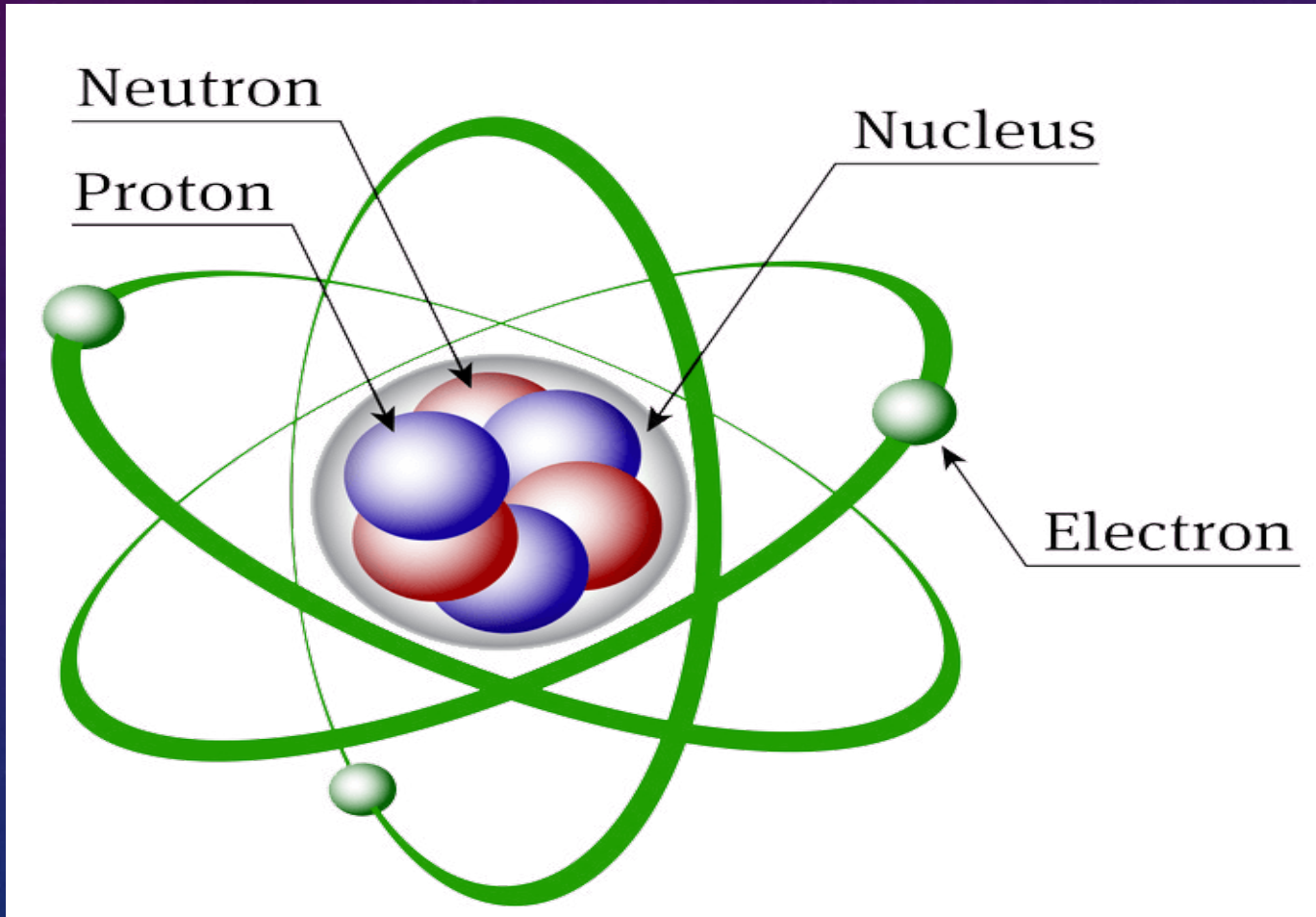


# DE BROGLIE



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

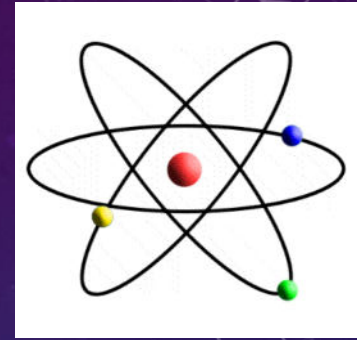
Atomic mass	28.0855
Symbol	Si
Atomic number	14
Name	Silicon



# PERIODIC ELEMENTS

Atomic mass	28.0855
Symbol	<b>Si</b>
Atomic number	<b>14</b>
Name	Silicon

# SUBATOMIC PARTICLES



Particle	Charge	Mass	Location
Proton ( $p^+$ )	+ charge	1	nucleus
Neutron ( $n^0$ )	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 = 
$$\frac{(\text{Mass})(\%) + (\text{Mass})(\%)}{100}$$



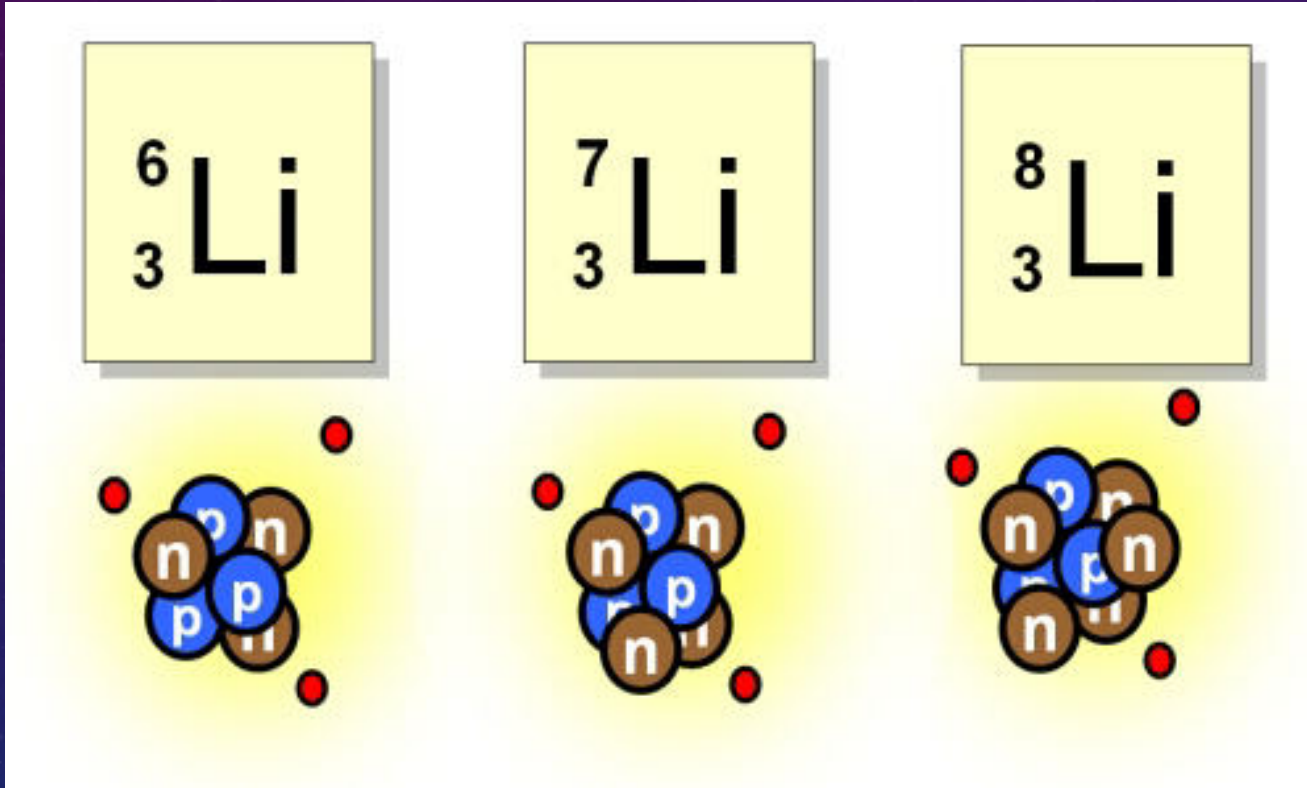
Stable



Stable

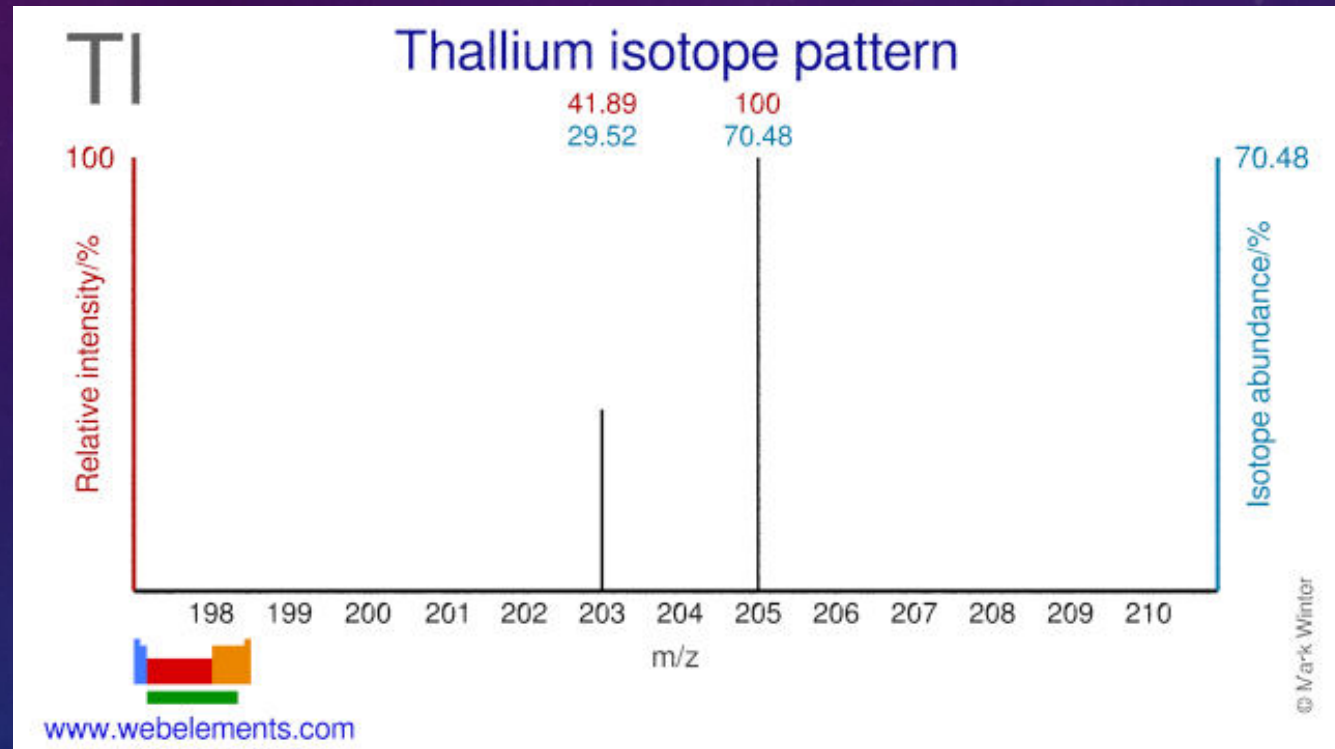


# ISOTOPES



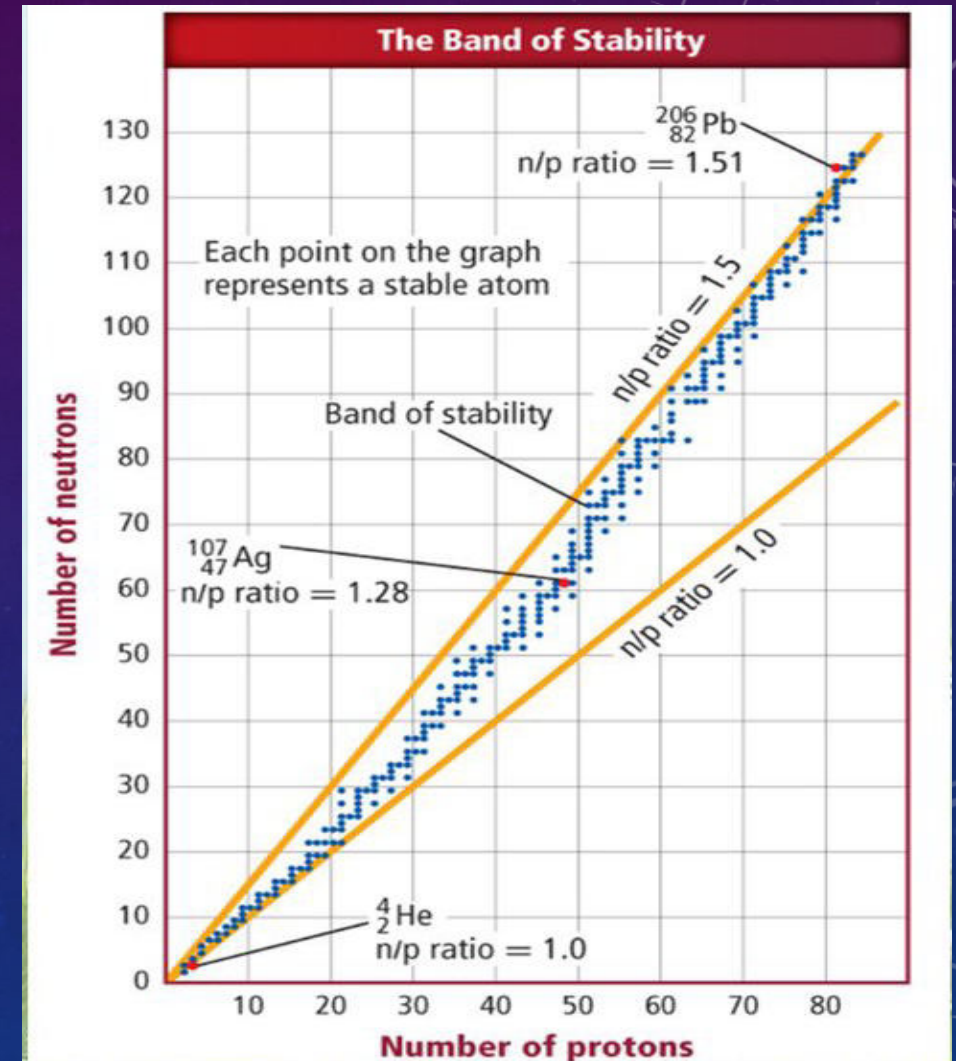
- Same # of protons
- Different # of neutrons
- Different mass number
- Different properties

# MASS SPECTROSCOPY



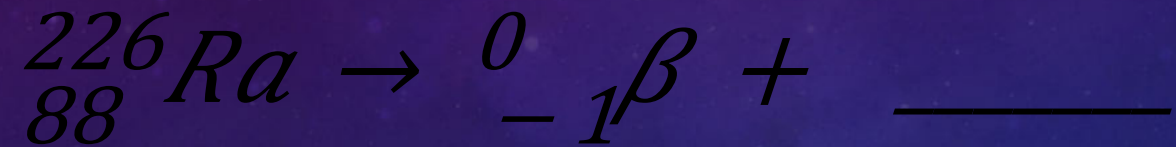
# RADIOACTIVITY

- 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

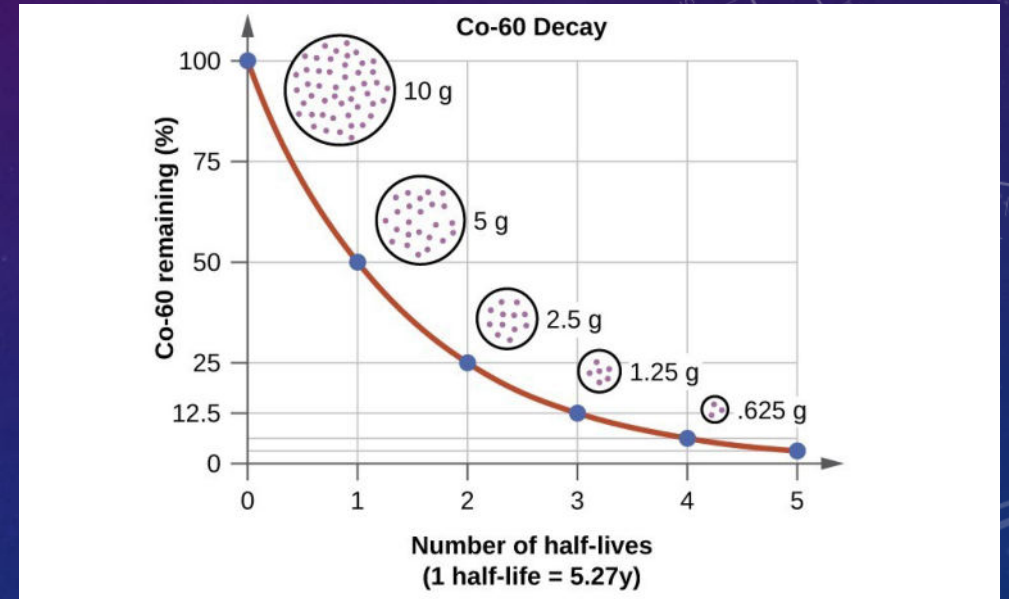


# HALF- LIFE CALCULATIONS

# of decay cycles =  
*amount of time passed*

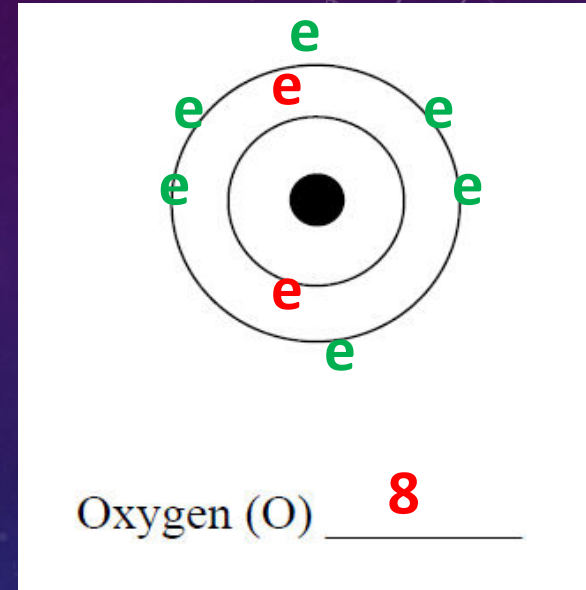
*length of one half life*

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**



Periodic Table of the Elements  
For Assessments Based on the 2010 Chemistry Standards of Learning

Atomic mass: 28.0855  
Symbol: **Si**  
Name: Silicon

Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	H 1 Hydrogen																	He 2 Helium
2	Li 3 Lithium	Be 4 Beryllium	Transition Elements										B 5 Boron	C 6 Carbon	N 7 Nitrogen	O 8 Oxygen	F 9 Fluorine	Ne 10 Neon
3	Na 11 Sodium	Mg 12 Magnesium											Al 13 Aluminum	Si 14 Silicon	P 15 Phosphorus	S 16 Sulfur	Cl 17 Chlorine	Ar 18 Argon
4	K 19 Potassium	Ca 20 Calcium	Sc 21 Scandium	Ti 22 Titanium	V 23 Vanadium	Cr 24 Chromium	Mn 25 Manganese	Fe 26 Iron	Co 27 Cobalt	Ni 28 Nickel	Cu 29 Copper	Zn 30 Zinc	Ga 31 Gallium	Ge 32 Germanium	As 33 Arsenic	Se 34 Selenium	Br 35 Bromine	Kr 36 Krypton
5	Rb 37 Rubidium	Sr 38 Strontium	Y 39 Yttrium	Zr 40 Zirconium	Nb 41 Niobium	Mo 42 Molybdenum	Tc 43 Technetium	Ru 44 Ruthenium	Rh 45 Rhodium	Pd 46 Palladium	Ag 47 Silver	Cd 48 Cadmium	In 49 Indium	Sn 50 Tin	Sb 51 Antimony	Te 52 Tellurium	I 53 Iodine	Xe 54 Xenon
6	Cs 55 Cesium	Ba 56 Barium	La 57 Lanthanum	Hf 72 Hafnium	Ta 73 Tantalum	W 74 Tungsten	Re 75 Rhenium	Os 76 Osmium	Ir 77 Iridium	Pt 78 Platinum	Au 79 Gold	Hg 80 Mercury	Tl 81 Thallium	Pb 82 Lead	Bi 83 Bismuth	Po 84 Polonium	At 85 Astatine	Rn 86 Radon
7	Fr 87 Francium	Ra 88 Radium	Ac 89 Actinium	Rf 104 Rutherfordium	Db 105 Dubnium	Sg 106 Seaborgium	Bh 107 Bohrium	Hs 108 Hassium	Mt 109 Meitnerium									

Lanthanoid Series: Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu

Actinoid Series: Th, Pa, U, Np, Pu, Am, Cm, Bk, Cf, Es, Fm, Md, No, Lr

Mass numbers in parentheses are those of the most stable or most common isotopes.

Metals ← Nonmetals

Revised May 2011



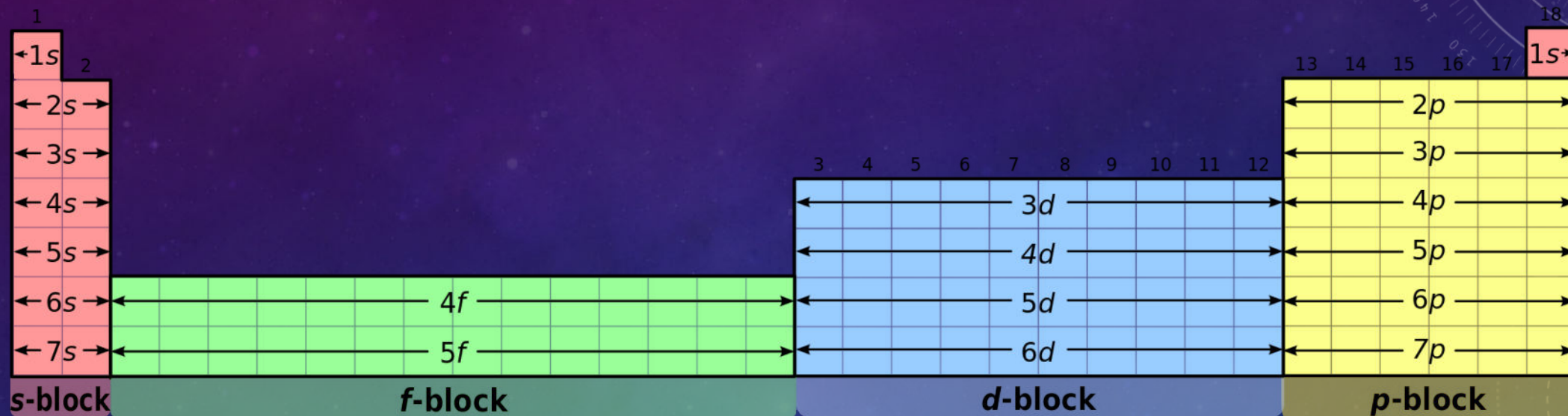
# FILLING ORBITALS

### 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



Orbital diagram for a neutral Vanadium atom (V) showing the filling of orbitals according to the Aufbau principle. The diagram shows orbitals from 1s to 4p. The 1s orbital is filled with two electrons (up and down arrows). The 2s orbital is filled with two electrons. The 2p orbitals are filled with two electrons (up and down arrows in the first orbital). The 3s orbital is filled with two electrons. The 3p orbitals are filled with two electrons (up and down arrows in the first orbital). The 4s orbital is filled with two electrons. The 3d orbitals are empty. The 4p orbitals are empty.



**Oxidation**    +1    +2

+2

**+3    X    -3    -2    -1    0**

## Noble Gases

**Alkali Metals**

**Alkaline Earth Metals**

**Transition Metals**

**Metalloids**

**Halogens**

**Lanthanoids**

**Actinoids**

by: Sarah Faizl

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