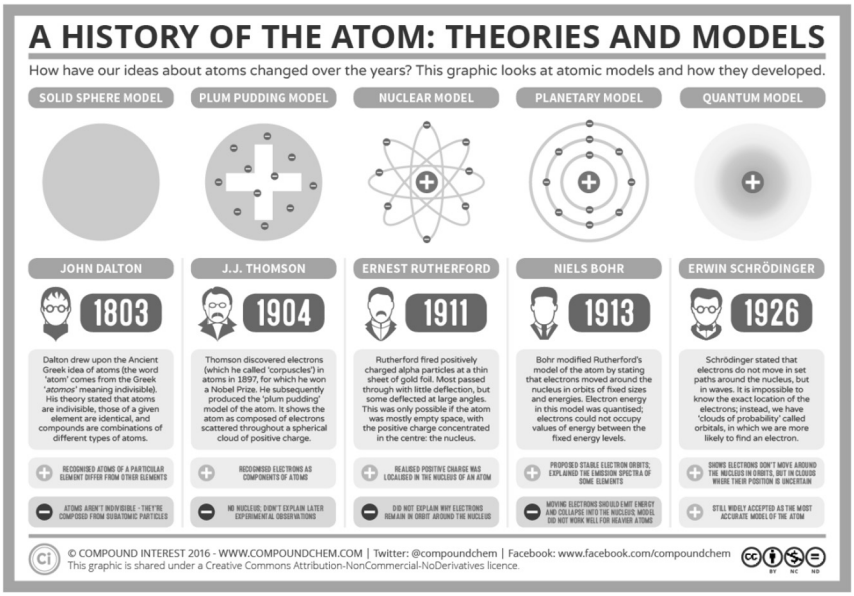
Studying Matter…

All materials on earth and the universe are made of matter. In this unit we will study the basic underpinning of matter…

The ATOM



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Role of Subatomic Particles

The modern atomic model contains protons, electrons, and neutrons *(+, -, and neutral*)

Protons

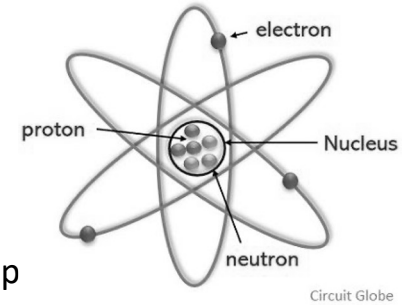
In nucleus (*center of atom*), identifies atom, keep electrons within the outer portion of the atom

Electrons

Atomic communication, connection to other atoms, balancing protons in the atom

Neutrons

Barrier between protons/electrons, sheilding



Basic Structure of the Atom

Includes electrons (e^-), protons (p+), and neutrons (n^o)

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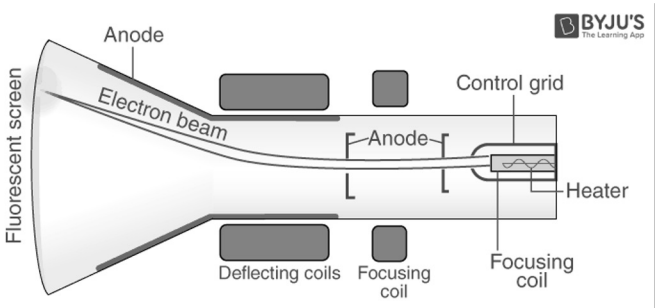
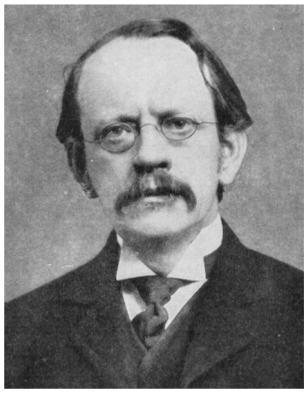
Subatomic Particles

Thomson's Cathode Ray Experiments

Thomson worked with Cathode "Canal" Rays in a vacuum to determine the energy and charge of e^-



Cathode Ray Tube Experiment



Joseph John Thomson

English Chemist

1856 - 1940AD

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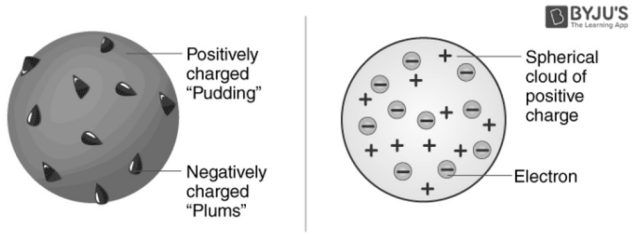
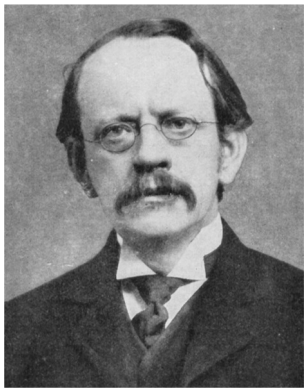
Subatomic Particles

Thomson's Plum Pudding Model

Thomson's discovery of the electron (e^-) lead to the *plum pudding model,* e^- in an atom surrounded by a positive *matrix*



Thomson's model of an atom



Joseph John Thomson

English Chemist

1856 - 1940AD

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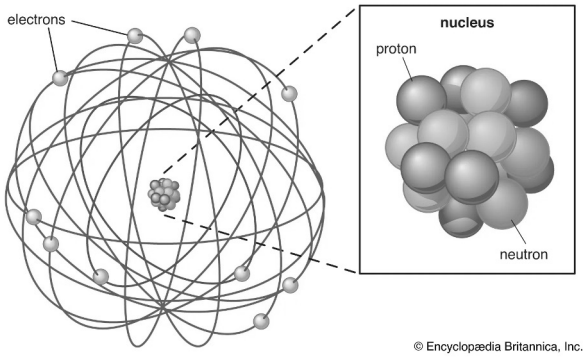
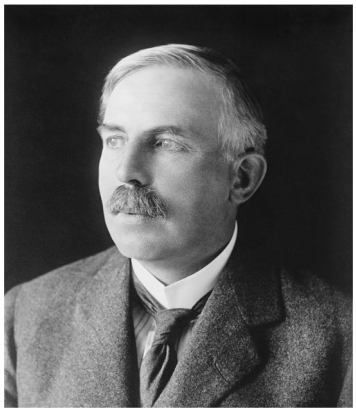
Subatomic Particles

Rutherford's Atomic Model

Strong positive center to the atom (*nucleus*) surrounded by negatively charged electrons (e^-)





Earnest Rutherford

New Zealand Chemist

1871 - 1931AD

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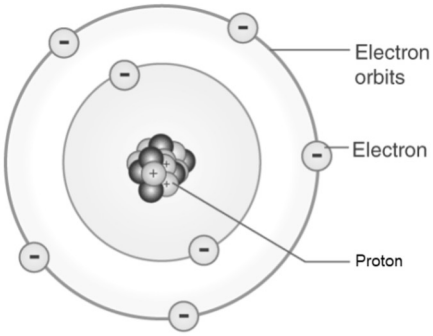
Subatomic Particles

Bohr's Atomic Model

e^- travel in orbits around the center of the atom

Atomic Orbits
Pathways around nucleus e^- travel in to maintain distance between other e^- and keep e^- and p^+ from colliding (*nucleus*)



Bohr atomic model of a Nitrogen atom

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Neil Bohr

Polish Chemist

1885 - 1962AD

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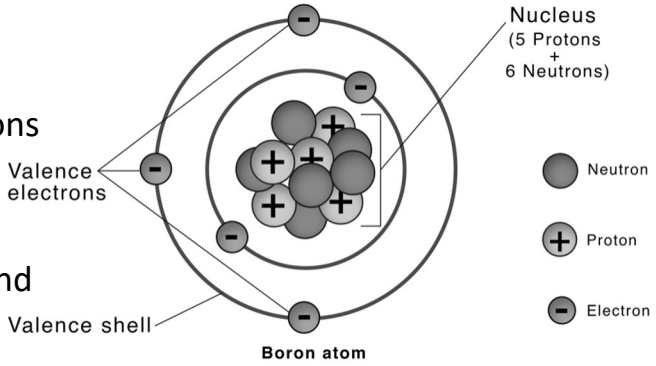
Subatomic Particles

Inner and Valence Electrons (e^-)

Electrons contain different roles within the atom

Inner (*Shell*) Electrons
Provide repulsive force (- to -) helping protect valence electrons

Valence (*Outer*) Electrons
Electrons that communicate (*transferred or shared*) and bond (*connect*) with other atoms



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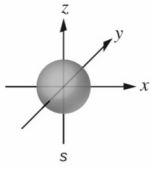
Subatomic Particles

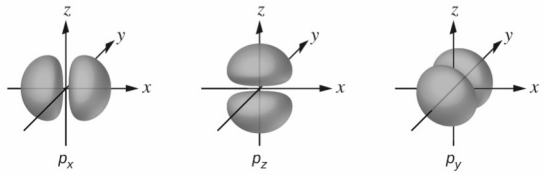
Atomic Orbitals and Electron Filling

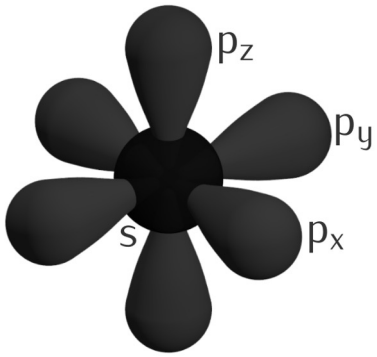
Orbitals are predicted electron locations around the atom to minimize electron repulsion in the orbitals.

0, 1 or 2 e^- allowed per orbital



Electrons always fill one per suborbital before pairing together





Overall Orbital Set
8 electrons fit within 4 orbitals in the s, p_x, p_y, p_z orbital set

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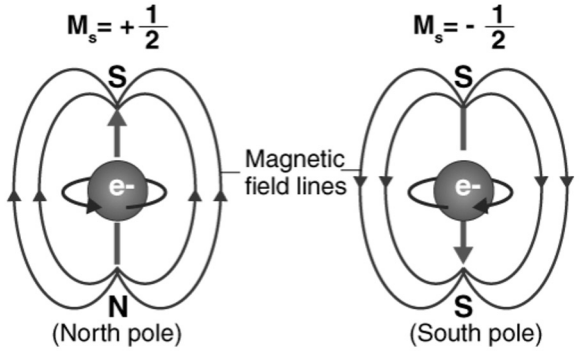
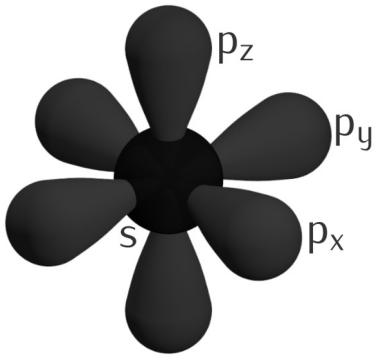
Subatomic Particles

Atomic Orbital Electron Spin

Within an orbital electrons spin in opposite directions (+1/2 and -1/2) to min. replusion





Overall Orbital Set

8 electrons fit within 4 orbitals in the s, p_x, p_y, p_z orbital set

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Subatomic Particles

Counting Valence Electrons (e^-) [*Representative Groups*]

Valence Electrons are based on group on the table

Group	Name	Val e^-	Group		Val e^-
1A (1)	Alkali Metals	1	5A (15)	Pnictogens	5
2A (2)	Alkali Earth Metals	2	6A (16)	Chalcogens	6
3A (13)	Earth Metals	3	7A (17)	Halogens	7
4A (14)	Carbon Group	4	8A (18)	Noble Gases	8

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Subatomic Particles

Counting Valence Electrons (e^-) [*Transition Metals*]

Valence Electrons are based on group on the table
Transition Metals can have 1 – 7 valence electrons (*base 2*)

Group	3B (3)	4B (4)	5B (5)	6B (6)	7B (7)	8B (8)	8B (9)	8B (10)	1B (11)	2B (12)
Element	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn
Possible Valence electron	3	3 4	2 3 4 5	2 3 4 6	2 3 4 5 7	2 3 6	2 3	2 3	1 2 3	2

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