

Day 8—Atomic Theory/Structure

I. Scientists who contributed to the Atomic Theory:

1. Democritus—named the atom(believed it to be indivisible)
2. Dalton—Four main pts:
 - a. All elements are composed of indivisible and indestructible atoms.
 - b. Atoms of the same element are identical.
 - c. Atoms of different elements are different.
 - d. Compounds are formed by the joining of the atoms of 2 or more elements.
3. Thomson—discovered electrons.
4. Rutherford—discovered the nucleus.
5. Bohr—proposed energy levels(with electrons)
6. Mosely—discovered protons (same one responsible for Modern Periodic table!!!!)
7. Chadwick—discovered neutrons.

Don't memorize,
recognize!!

II. Atomic Structure

***Must know the subatomic structures, their charge, where they're found, and their mass.

Subatomic Particle	Charge	Where found??	Mass
Proton	+	Nucleus	1 AMU
Neutron	Neutral	Nucleus	1 AMU
Electron	-	Energy levels	1/2000 AMU

Key Points:

1. Most of the mass of an atom is found in the nucleus!!!
2. Electrons in the outer energy levels(valence electrons) are involved with forming compounds.

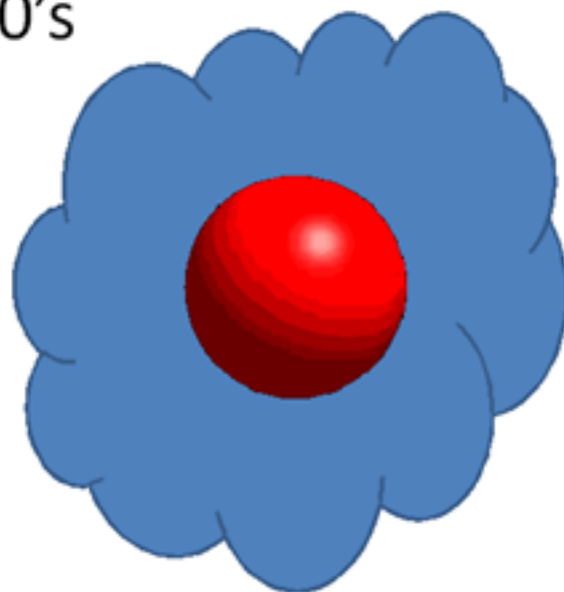
**Must know how many electrons each energy level will hold

- 1st—2 electrons
- 2nd—8 electrons
- 3rd—18 electrons
- 4th—32 electrons

III. Properties of Atom:

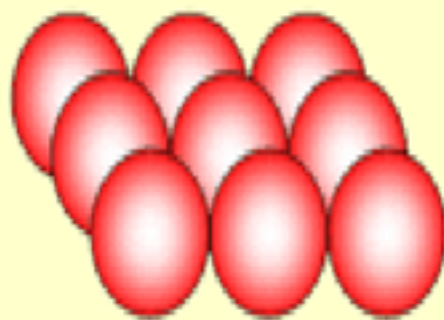
1. Atomic Number—# of protons
 - i. In a neutral atom, the # protons= # electrons
 - ii. # of Protons will not change
2. Mass #—Sum of protons + neutrons
 - i. Closest whole number to Atomic Mass!!
Ex) Oxygen—Atomic Mass= 15.9994
-therefore, Mass # 16
3. Atomic Mass—mass of atom in Atomic Mass Units
 - i. Given on periodic table as average of mass of all isotopes.

John Dalton: early 1800's

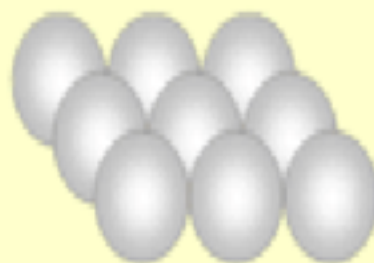


John Dalton's Atomic Theory

All matter is made of atoms. Atoms are indestructible and can not be broken into pieces

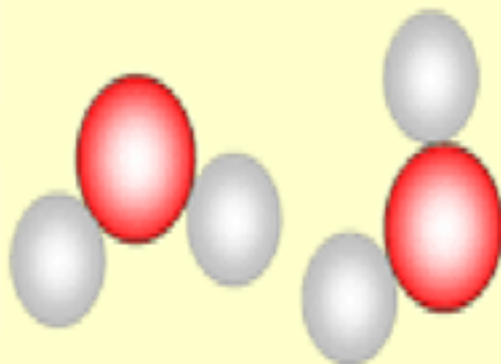


All the atoms of a particular element are identical to each other and different from the atoms of other elements



Atoms are rearranged in a chemical reaction.

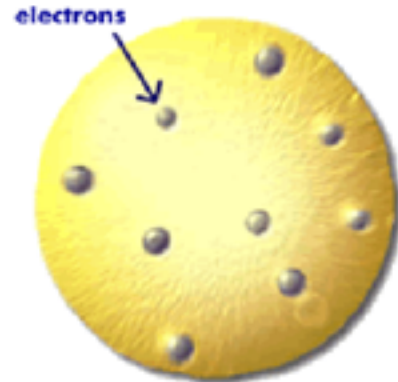
Compounds are formed when two or more different kinds of atoms join together.



JJ Thomson--1897



Thomson discovered the electron!!!



sphere of positive charge

Plum Pudding Model

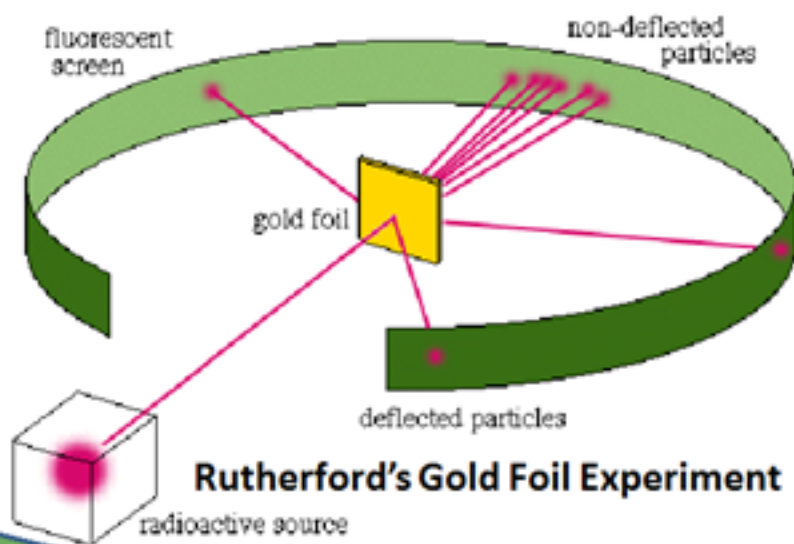
But the atom is Neutral!!!!



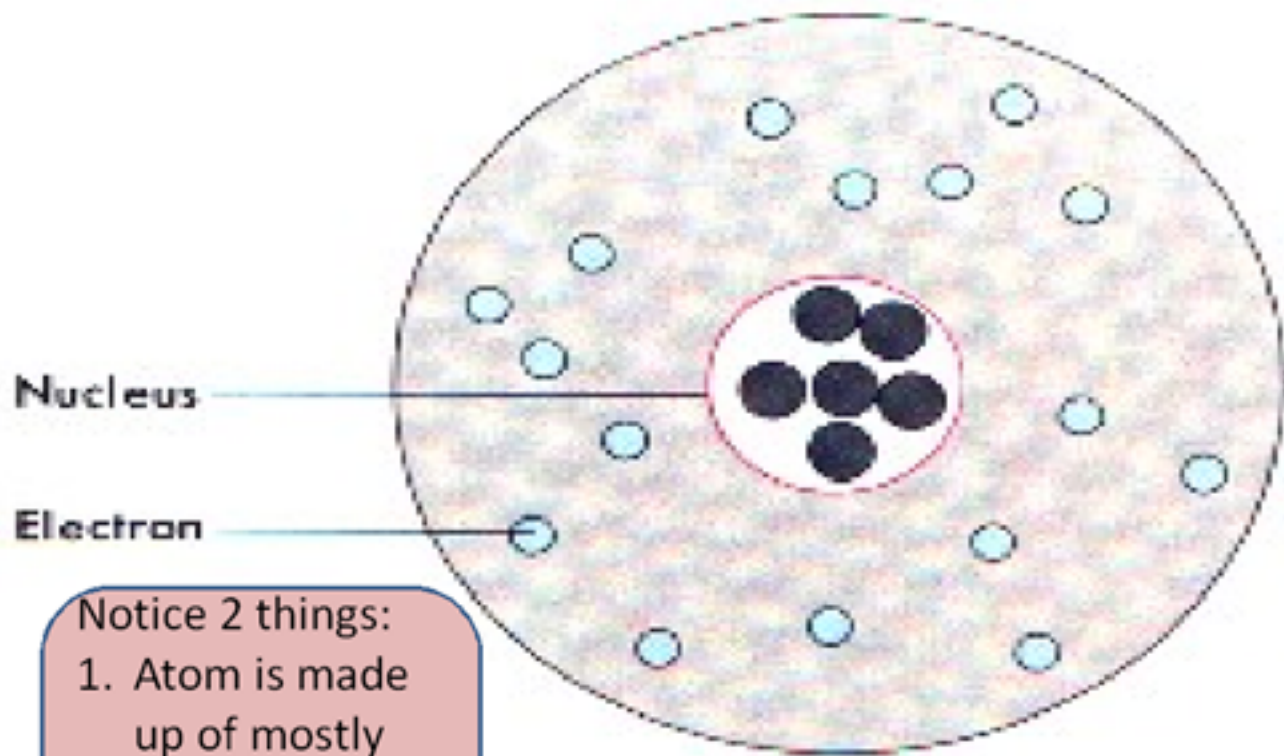
Aristotle



Ernest Rutherford--1908



Rutherford discovered the nucleus!!!



Nucleus

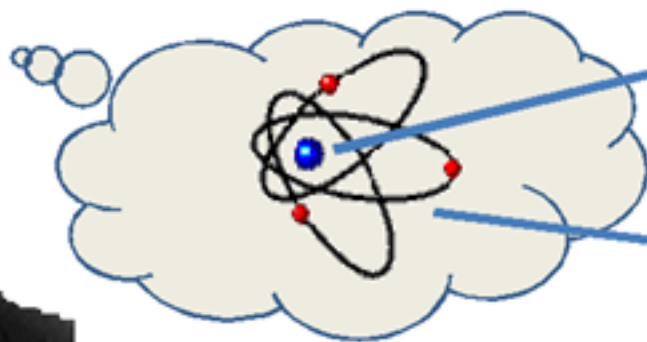
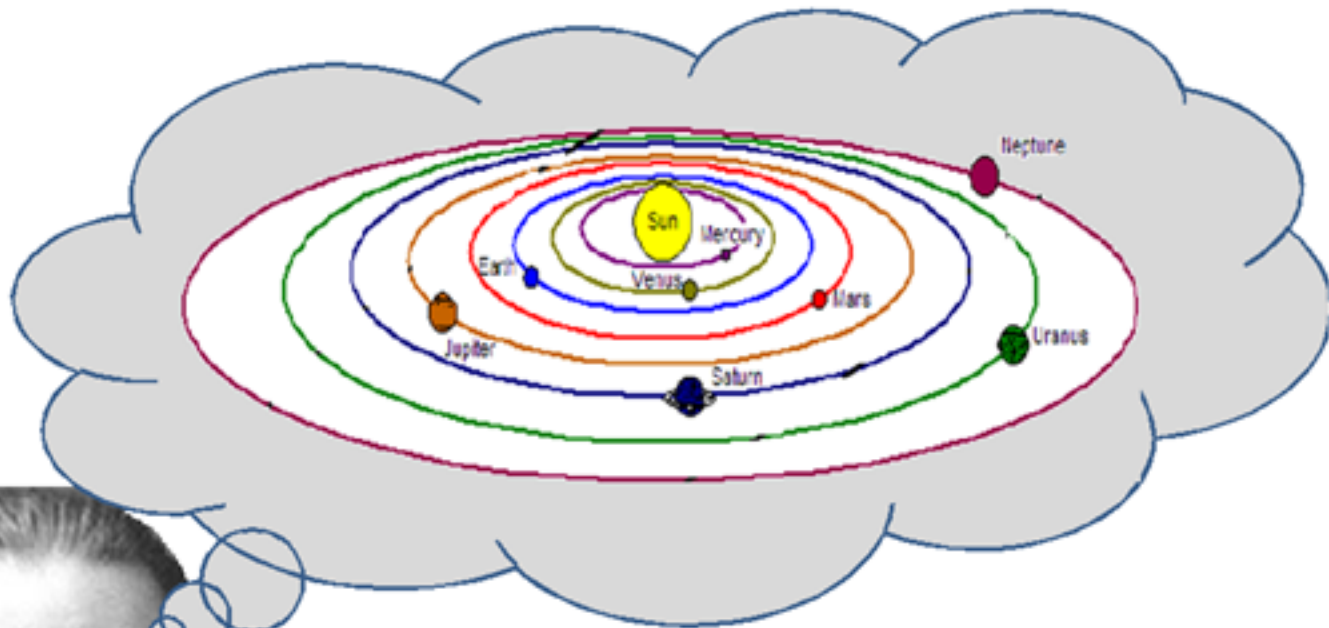
Electron

Notice 2 things:

1. Atom is made up of mostly empty space.
2. Electrons are scattered randomly!

Rutherford's Atomic Model



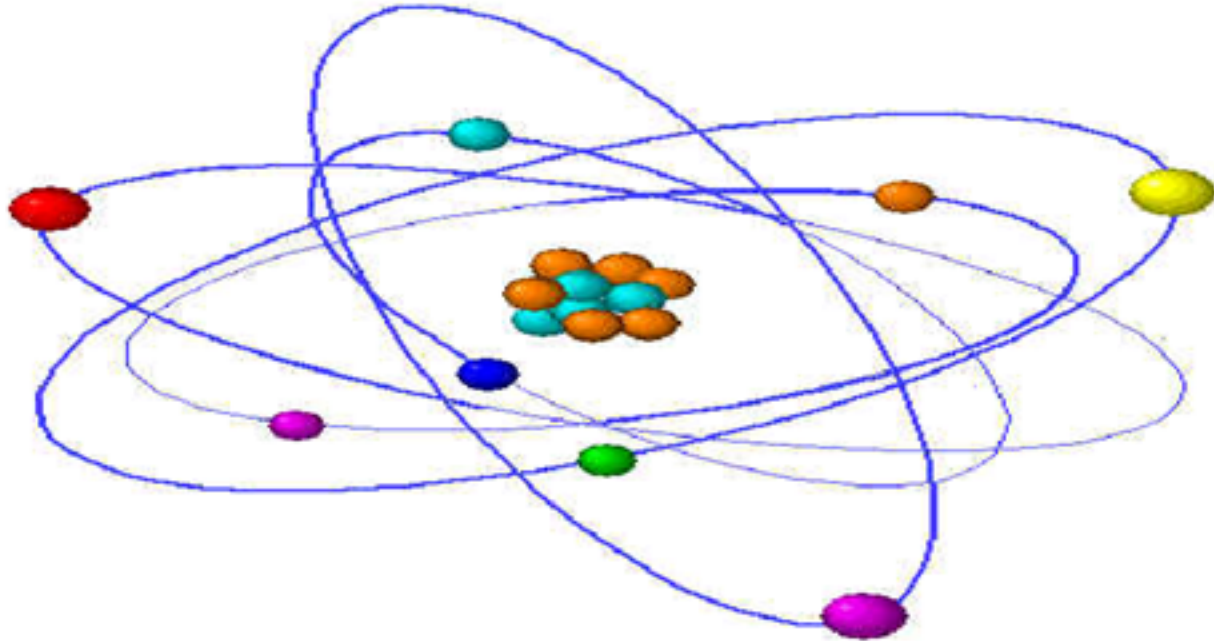


Nucleus

Electrons

Neils Bohr--1913

Bohr Model of the Atom



The Bohr Model has the following features:

1. There is a nucleus(Rutherford's Discovery)
2. The electrons move about the nucleus in "stationary, stable states"(later referred to as **orbits**)!

Our Changing View of the Atom

"Atomos" are the building blocks of matter.



Democritus/Dalton
Early Greek
Philosophers
400 B.C.

Negative electrons are embedded in a sea of positive charge.



J.J. Thomson
1898 - 1903

Positive charge is located within a central nucleus.



Ernest
Rutherford
1911

Electrons are in circular orbits with quantized energy levels.



Neils
Bohr
1913

Electrons occupy regions of space whose shape is described by complex mathematical equations.

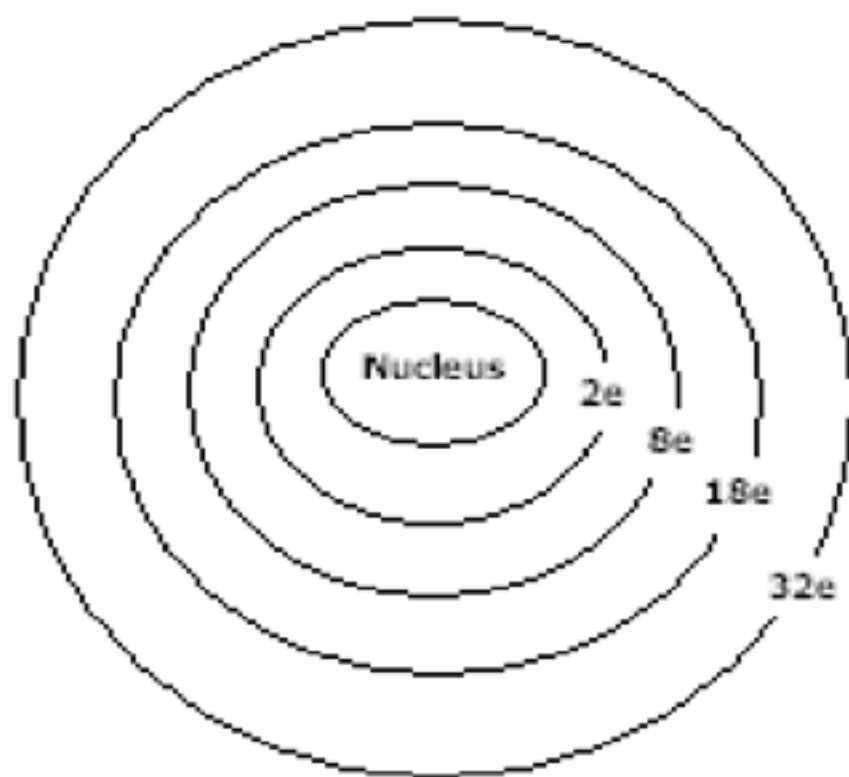


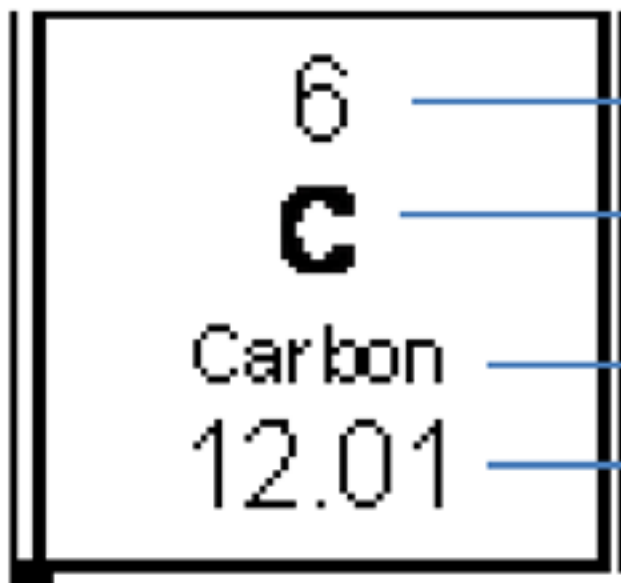
Quantum
Mechanics
Modern Model

3 Parts of the Atom:

Subatomic Particle	Relative Mass	Charge	Where Found
Proton	1	+1	In Nucleus
Neutron	1	0(neutral)	In Nucleus
Electron	0	-1	Outside nucleus in electron cloud

Each energy level can hold a specific #
of electrons:





Atomic Number



Chemical Symbol



Element



Average Atomic Mass

Atomic

- # of protons in an atom
 - In a *neutral* Atom, # of protons=# of electrons
- *Atomic # of a given element will never change, therefore, the # of protons of an element will never change.



Mass Number

- Sum of the protons and neutrons
 - Closest whole # to the Avg. Atomic Mass(from periodic table)
- EX) Oxygen Avg. Atomic Mass = 15.999
 - Therefore, Mass # = 16

Average Atomic Mass

- Mass of atom in Atomic Mass Units
 - i. Given on periodic table as average mass of all isotopes of that element.
 - a. The number of neutrons sometimes varies!!!
 - ii. Atomic Mass Unit—defined as 1/12 the mass of a Carbon-12 atom

4. Isotopes—atoms of an element with different # of neutrons
Ex) Hydrogen has 3 isotopes:
H-1, H-2, H-3
5. Ion—a charged ion
 - i. Charged because lost or gained electrons.

IV. Testing Questions involving Atomic Structures:

1. Complete the following and then draw structure of the given atoms!!
 **Will not have to draw atoms for the EOC but it will make life easier on you knowing how!!!!
 **Use information from the Periodic Table on Formula Sheet:

Element	Atomic #	Atomic Mass	Mass #	# of protons	# of electrons	# of neutrons
Boron						
Sodium						
Chlorine						

Isotopes

- Atoms of the same element with the same # of protons, but different # of neutrons.



2 ways of writing Isotopes

H-1 H-2 H-3



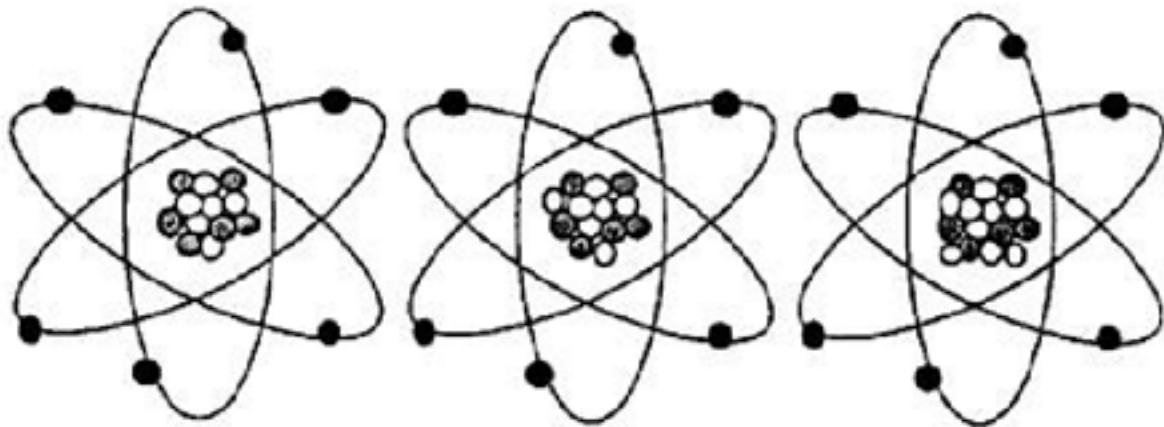
- Each of these represents Hydrogen
- The number represents the mass #

${}^{12}_{6}\text{C}$ ${}^{13}_{6}\text{C}$ ${}^{14}_{6}\text{C}$



- Each of these represents Carbon
- The top # represents the mass #
- The bottom # represents the Atomic #

Isotopes of Carbon



Carbon-12

6 protons
6 neutrons

Carbon-13

6 protons
7 neutrons

Carbon-14

6 protons
8 neutrons

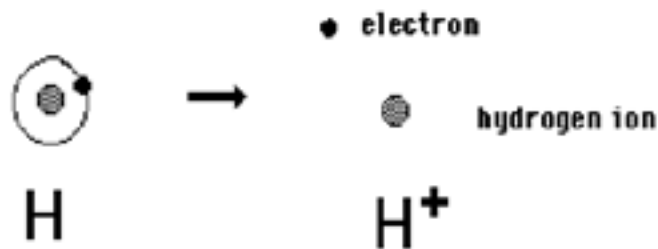
Ions

A “charged” atom.

- Atoms become charged by gaining or losing electrons.
- 2 Types of Ions:

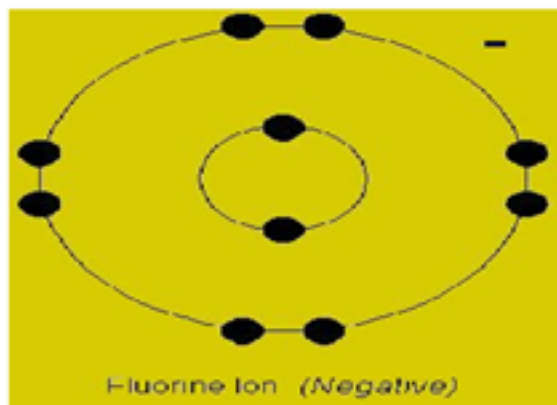
1. + ions

Atoms become (+)
by losing electrons



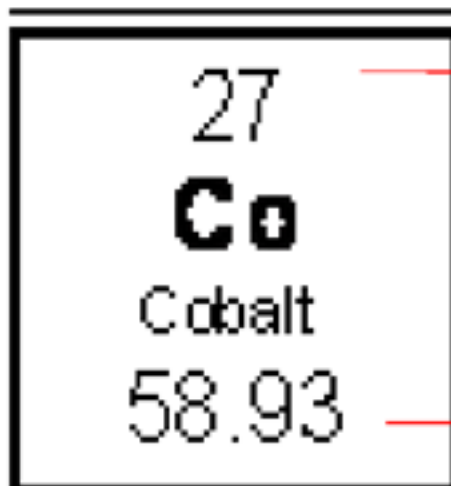
2. - ions

Atoms become (-)
by gaining electrons



Using the Periodic Table to determine the # protons, # electrons, and # of neutrons:

1. Determine the Atomic # and Mass #
2. Atomic # = # protons
 - a) # protons = # electrons
3. Mass # = # neutrons + # protons



Atomic #

Atomic Mass

$$A \# = 27$$

$$M \# = 59$$

$$\# p = 27$$

$$\# e = 27$$

$$\# n = 32$$

$$M \# = \# p + \# n$$

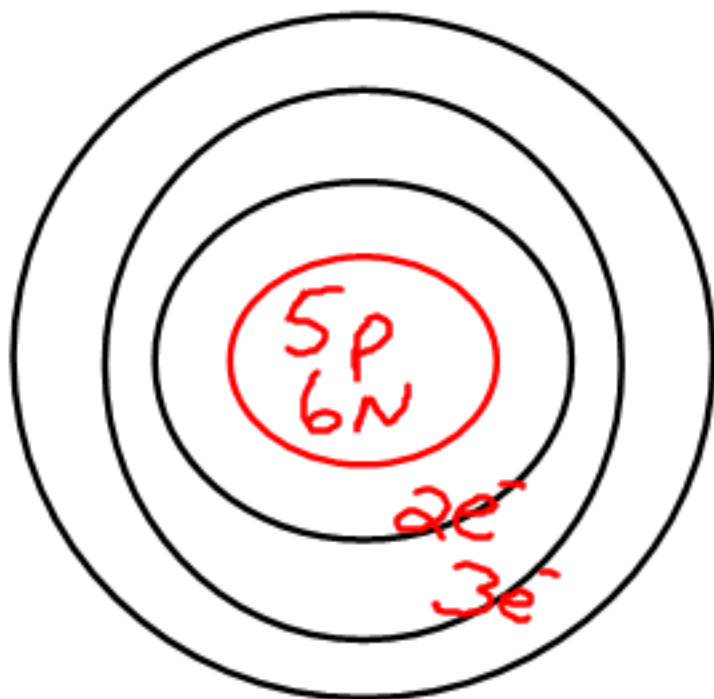
$$59 = 27 + \# n$$

Element	Atomic #	Atomic Mass	Mass #	# of protons	# of electrons	# of neutrons
Boron	5	10.81	11	5	5	6
Sodium	11	22.99	23	11	11	12
Chlorine	17	35.45	35	17	17	18

Draw Boron:

A#5
M#11

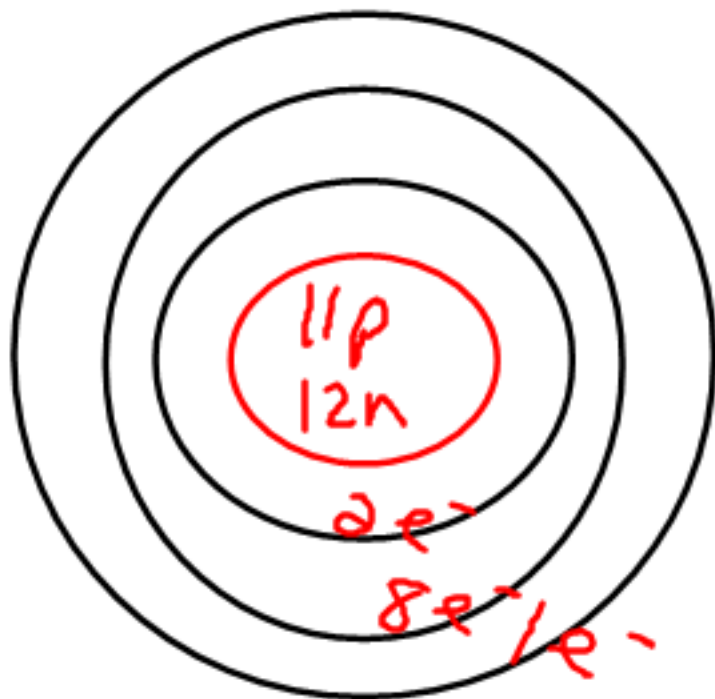
P-5
N-6
e-5



Draw Sodium:

A#11
M#23

P-11
N-12
e-11



Draw Chlorine:

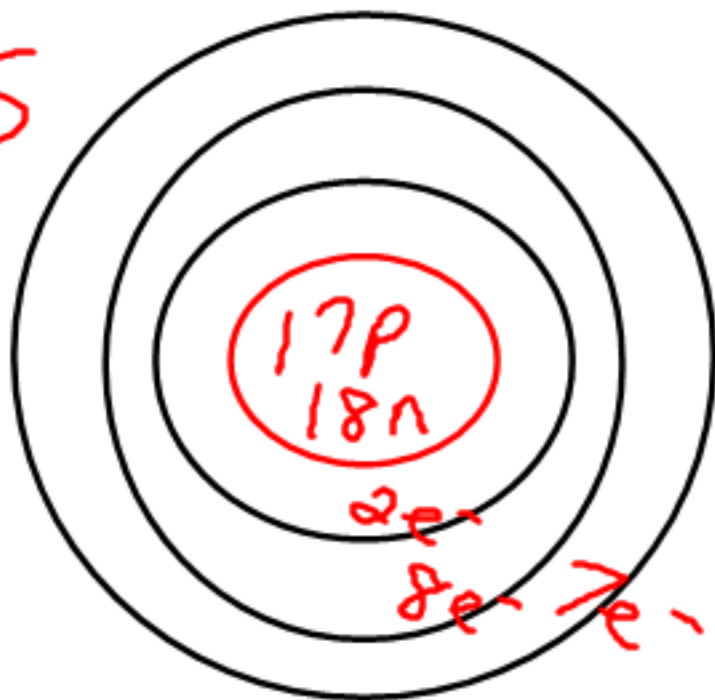
A#17

M#35

P-17

N-18

e-17

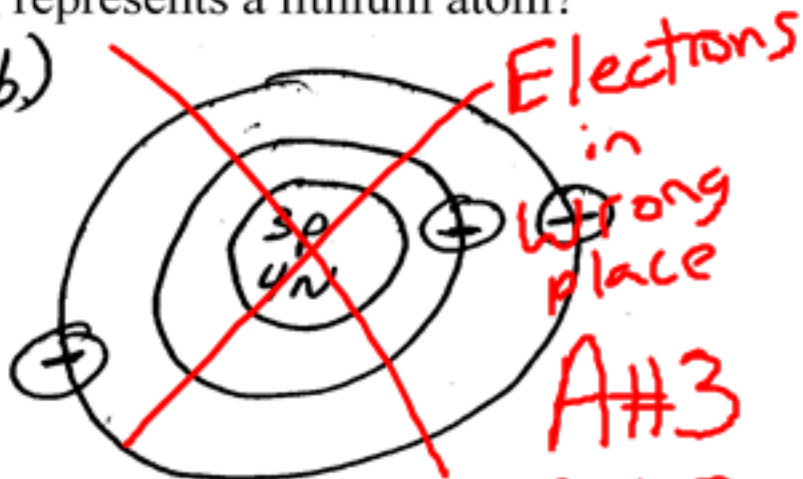


EX). Which of the following represents a lithium atom?

a.)



b.)



A#3

M#7

c.)



d.)

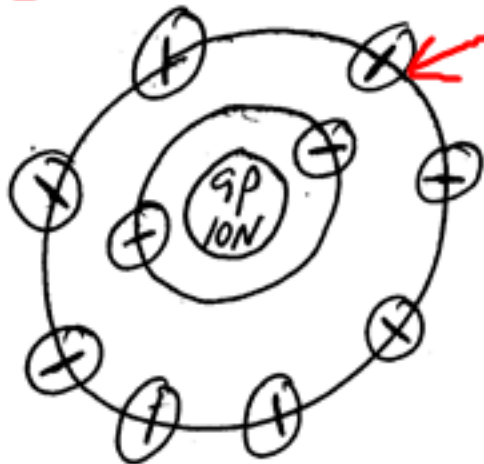


EX) Which of the following represents a negatively charged fluorine ion?

a.)



b.)



1 more electron

Neutral

A#9

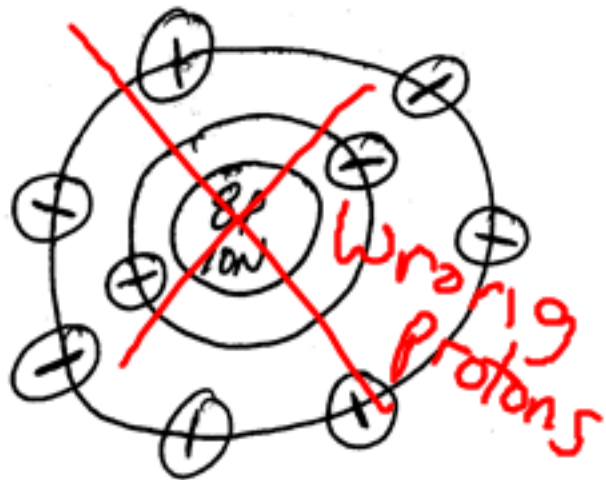
M#19

P-9

e-9

n-10

c.)



d.)



Our Changing View of the Atom

"Atomos" are the building blocks of matter.



Negative electrons are embedded in a sea of positive charge.



Positive charge is located within a central nucleus.



Electrons are in circular orbits with quantized energy levels.



Electrons occupy regions of space whose shape is described by complex mathematical equations.



Early Greek
Philosophers
400 B.C.

J.J. Thomson
1898 - 1903

Ernest
Rutherford
1911

Neils
Bohr
1913

Quantum
Mechanics
Modern Model

Structure of the Atom Worksheet

The model of the atom includes a positively charged center, or nucleus which contains two particles, the protons and neutrons. The number of protons is the Atomic Number of an atom. A third particle, the electron, is found in a cloud outside the nucleus. An energy level in the electron cloud is similar to a shelf on a refrigerator. The mass of an electron is so small that it is impossible to describe exactly where it is in an atom.

