Target: I can describe advancements in the model of the atom, and can count subatomic particles

N5 - ATOMIC #'S & ISOTOPES

Link to YouTube Presentation: https://youtu.be/vDzHcK1MUHo

DALTON'S ATOMIC THEORY (1808)

John Dalton

1) All matter composed of extremely small particles called atoms

DALTON'S ATOMIC THEORY (1808)

John Dalton

2) Atoms of a given element are identical in size, mass, and other properties

DALTON'S ATOMIC THEORY (1808)

John Dalton

3) **Atoms of different elements differ in size, mass, and other properties**

DALTON'S ATOMIC THEORY (1808)

John Dalton

4) **Atoms cannot be subdivided, created, or destroyed**

DALTON'S ATOMIC THEORY (1808)

John Dalton

5) Atoms of different elements combine in simple whole-number ratios to form chemical compounds

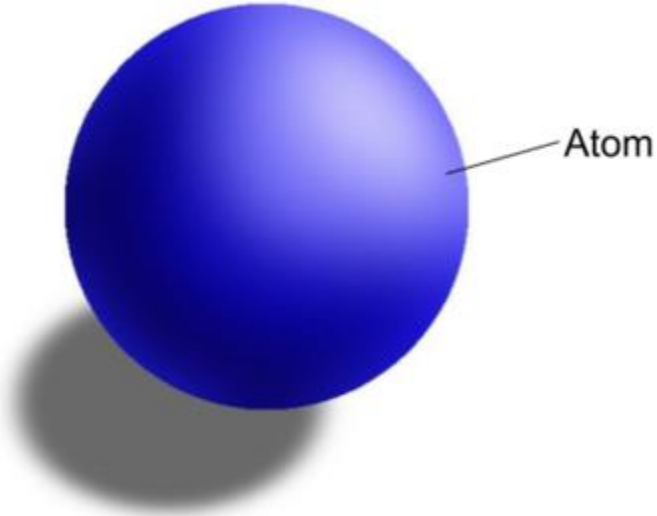
DALTON'S ATOMIC THEORY (1808)

John Dalton

6) **In chemical reactions, atoms are combined, separated, or rearranged**

DALTON'S BILLIARD BALL MODEL

John Dalton

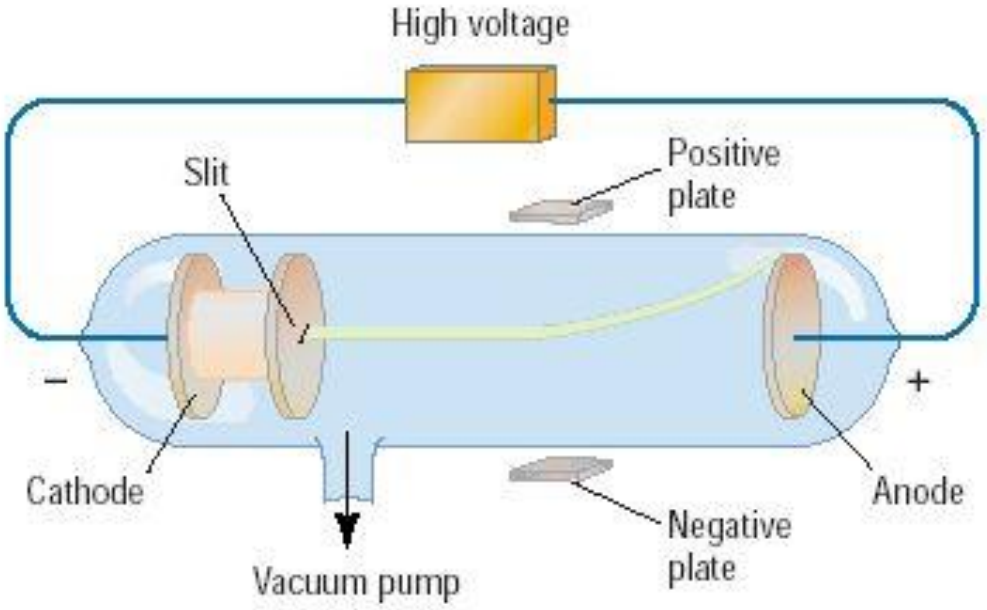


MODERN ATOMIC THEORY – WHAT WAS WRONG WITH DALTON'S THEORY?

Atoms have an AVERAGE MASS!	It is an AVERAGE because of ISOTOPES!
Atoms cannot be divided, created or destroyed during NORMAL chemical reactions	BUT they CAN do those things during NUCLEAR reactions!

DISCOVERY OF THE ELECTRON

In 1897, J.J. Thomson used a cathode ray tube to deduce the presence of a negatively charged particle.



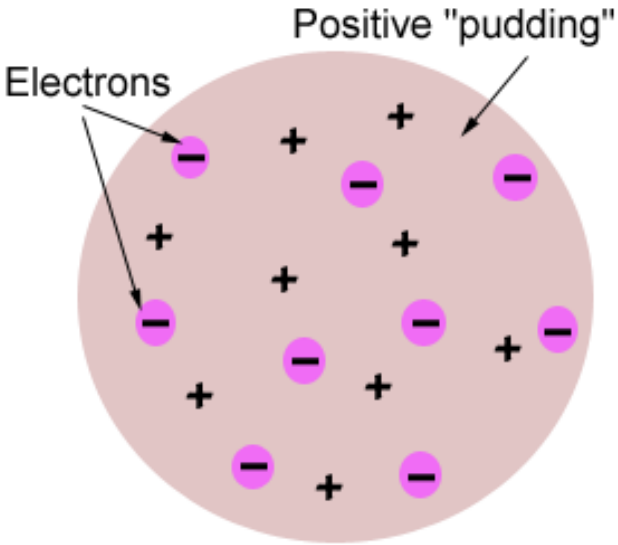
Cathode ray tubes pass electricity through a gas that is contained at a very low pressure.

https://www.youtube.com/watch?v=O9Goyscbazk

CONCLUSIONS FROM THE STUDY OF THE ELECTRON

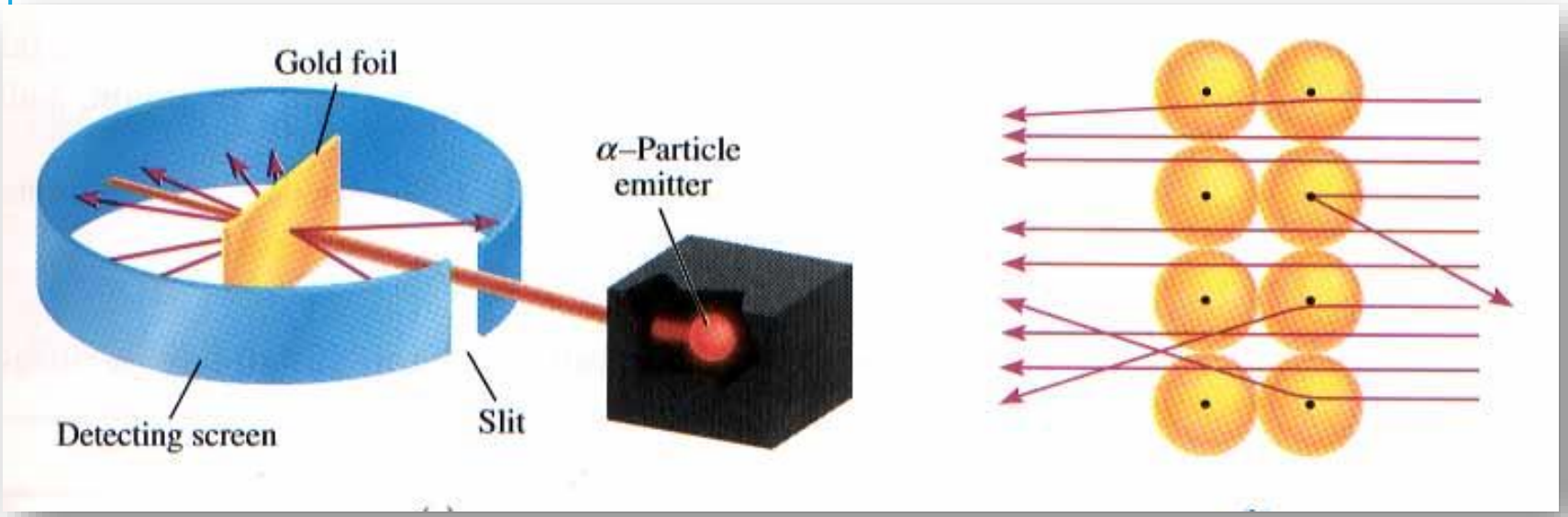
Cathode rays have identical properties regardless of element used →	**All elements must contain identically charged electrons.**
Atoms are neutral →	**Must be positive particles balancing the negative charge of electrons**
Electrons have very little mass compared to the atom's mass →	**Atoms must contain other heavier particles that account for most of the mass**

THOMSON'S ATOMIC MODEL



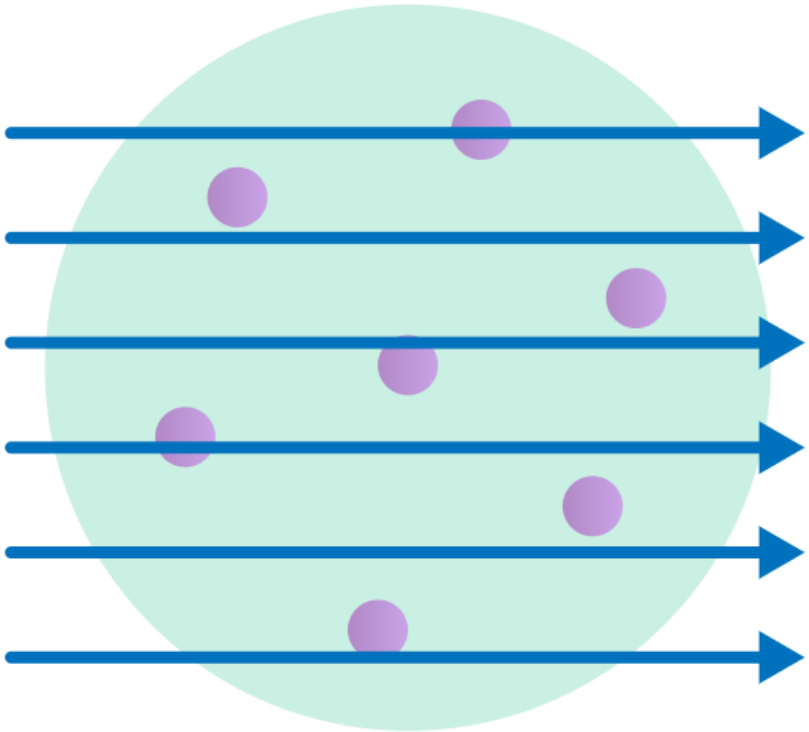
Thomson believed that the electrons were like plums embedded in a positively charged "pudding," thus it was called the "plum pudding" model. We don't usually eat plum pudding in this country, so I like to call it the chocolate chip cookie model.

RUTHERFORD'S GOLD FOIL EXPERIMENT

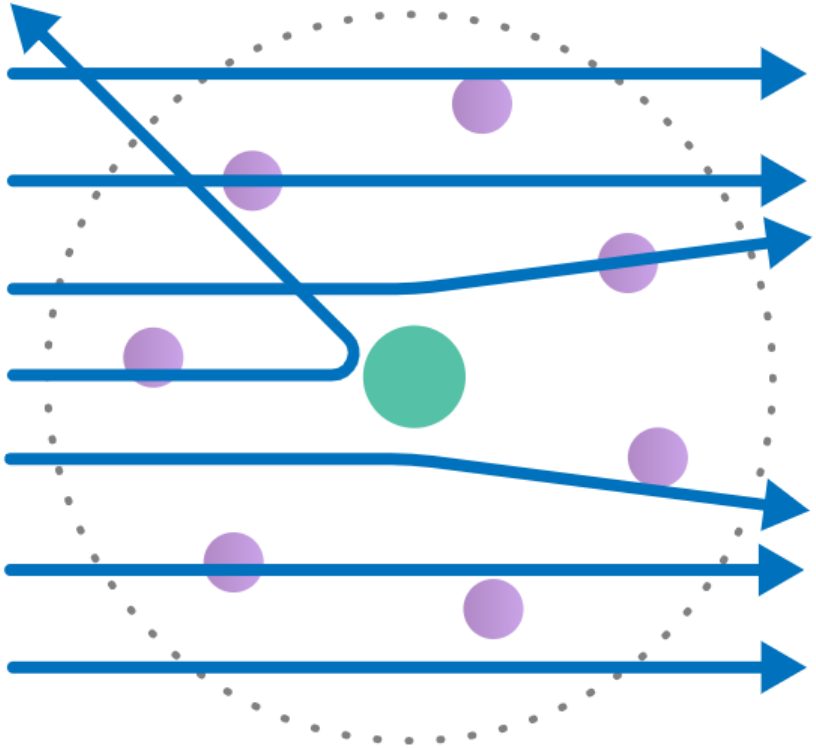


- Alpha (α) particles are helium nuclei
- Particles were fired at a thin sheet of gold foil
- Particle hits on the detecting screen (film) are recorded

THOMSON MODEL



RUTHERFORD MODEL



https://www.youtube.com/watch?v=XBqHkraf8iE

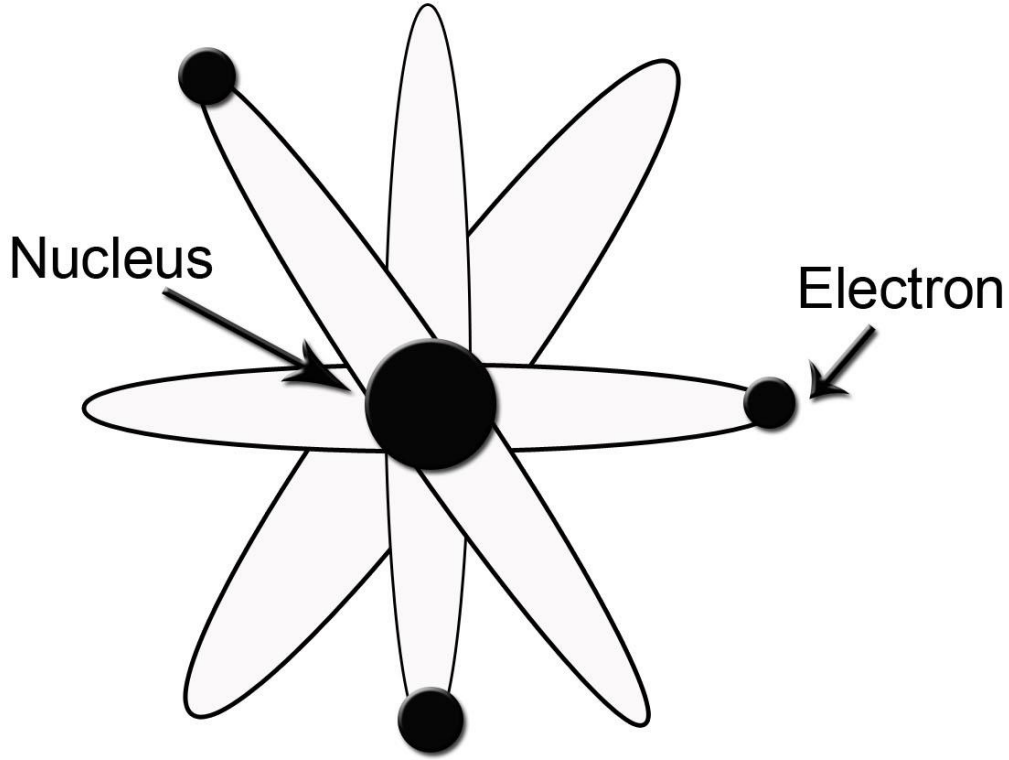
RUTHERFORD'S FINDINGS

1) Most of the particles passed right through
2) A few particles were deflected
3) A FEW were ***greatly*** deflected

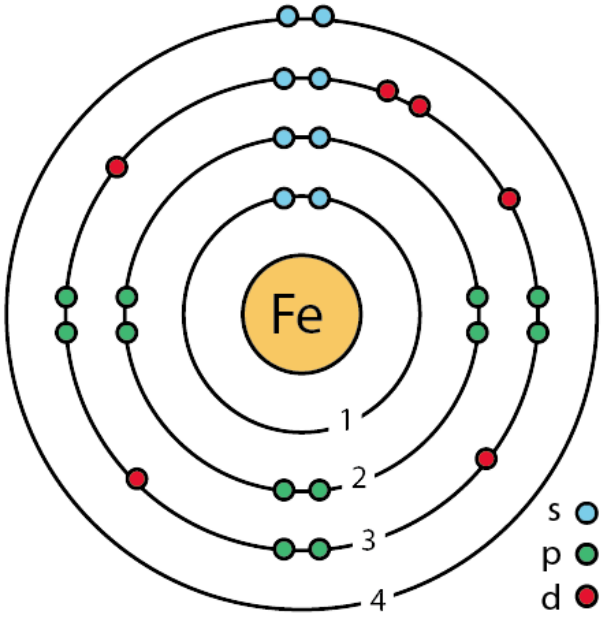
CONCLUSIONS:

- ❑ The nucleus is small
- ❑ The atom is mostly empty space
- ❑ The nucleus is dense
- ❑ The nucleus is positively charged

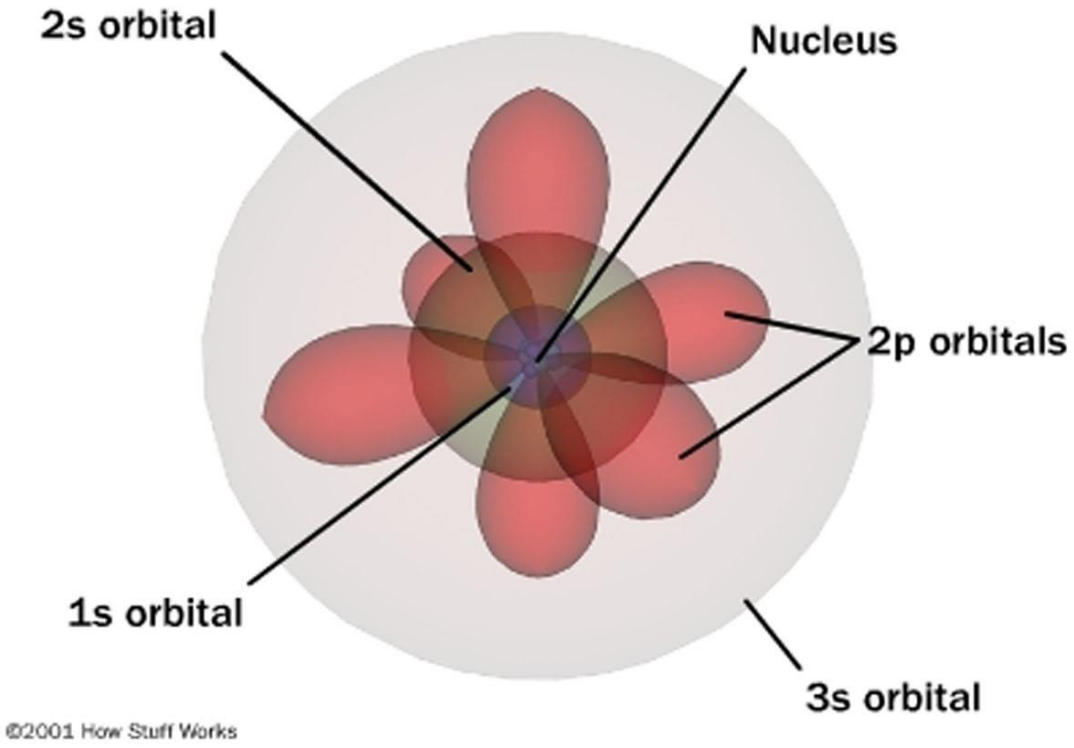
The Bohr Model



The "planet" model because it looks like the planets revolving around the sun. These Electrons have “paths” that they follow around the Nucleus in the center. Usually we DRAW atoms like this but its not accurate!



The Quantum Model



This is a hard model to understand.
The Electrons don't follow paths, they are not objects at all! Instead they are pure charge that has a probability of being somewhere in those orbitals.

ATOMIC PARTICLES

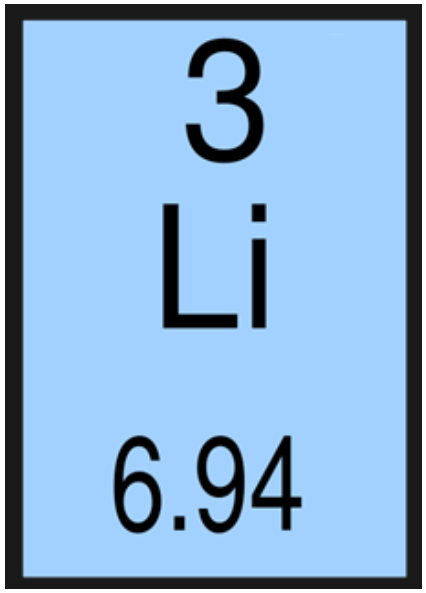
Particle	Charge	Mass #	Location
Electron	-1	0	Electron cloud
Proton	+1	1	Nucleus
Neutron	0	1	Nucleus

ATOMIC NUMBERS

We know: Nucleus has protons (p^+), neutrons (n^0), and electrons(e^-) are on the outside of nucleus

But how many of each???

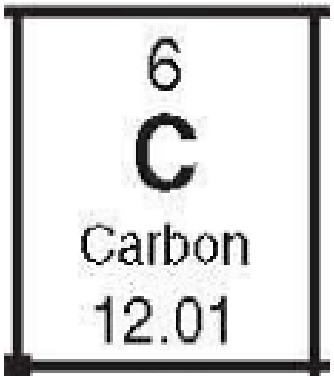
Atomic Mass Number
(round to the nearest whole #)
# of protons + # of neutrons



Atomic Number
# of protons

# of electrons
=
# of protons

ATOMIC NUMBER



The number of protons in the nucleus of each atom of that element.

Element	# of protons	Atomic # (Z)
Carbon	6	6
Phosphorus	15	15
Gold	79	79

Changing Protons makes a new

ELEMENT

with a NEW name!

Sodium has 11 protons. Take one away and it has 10 and is no longer sodium…it is now Neon!

WHICH OF THE FOLLOWING DETERMINES THE IDENTITY OF AN ATOM?

A. Number of protons
B. Number of electrons
C. Number of neutrons
D. Total number of protons and neutrons
E. Total number of protons and electrons

WHICH OF THE FOLLOWING DETERMINES THE IDENTITY OF AN ATOM?

A. *Number of protons*

B. Number of electrons

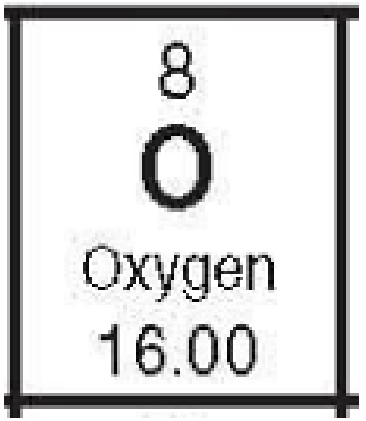
C. Number of neutrons

D. Total number of protons and neutrons

E. Total number of protons and electrons

MASS NUMBER

The number of protons and neutrons in the nucleus of an isotope.



Mass # = p^+ + n^0

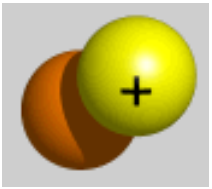
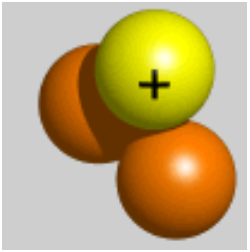
Nuclide	p^+	n^0	e^-	Mass #
Oxygen - 18	8	10	8	18
Arsenic - 75	33	42	33	75
Phosphorus - 31	15	16	15	31

Changing Neutrons makes a new

ISOTOPE

ISOTOPES

Atoms of the same element having different masses due to varying numbers of neutrons.

Isotope	Protons	Electrons	Neutrons	Nucleus
Hydrogen–1 (protium)	1	1	0	
Hydrogen-2 (deuterium)	1	1	1	
Hydrogen-3 (tritium)	1	1	2	

AVERAGE ATOMIC MASSES

The average of all the naturally occurring isotopes of that element.

Isotope	Symbol	Composition of the nucleus	% in nature
Carbon-12	^{12}C	6 protons 6 neutrons	98.89%
Carbon-13	^{13}C	6 protons 7 neutrons	1.11%
Carbon-14	^{14}C	6 protons 8 neutrons	<0.01%

Carbon = 12.011

Changing Electrons makes

a new

ION

IONS

When you change the number of electrons in an atom.

Ion	Change	# of P to # of e-	Charge	Example symbol
Cation	Lost electrons	P > e-	positive	Ca^{2+}
Anion	Gained electrons	P < e-	negative	N^{3-}

Sodium

Normally:	11 protons	+11
	11 electrons	-11
	zero charge	0

Sodium

Take away:	11 protons	+11
an electron	10 electrons	-10
	positive charge	+1

Oxygen

Normally:

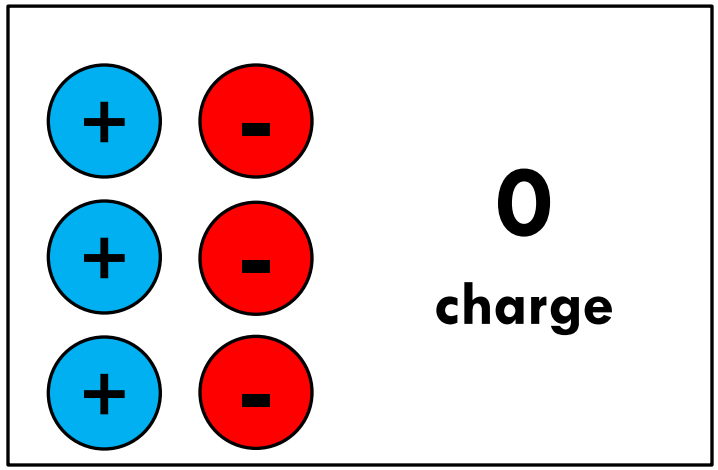
8 protons	+8
8 electrons	-8
zero charge	0

Oxygen

Give 2 extra: 8 protons +8

electrons 10 electrons -10

negative charge -2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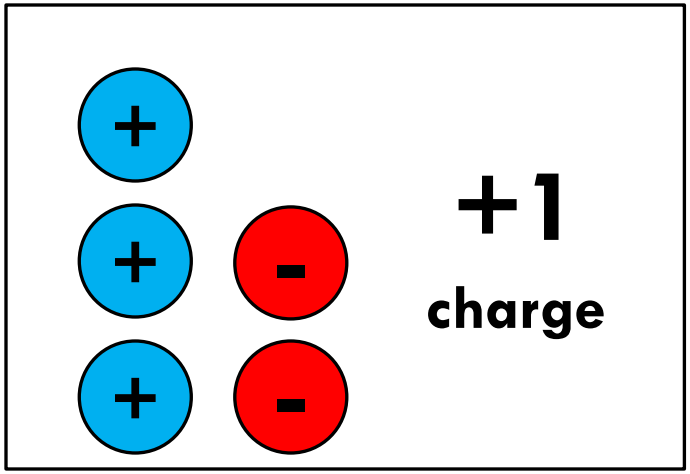
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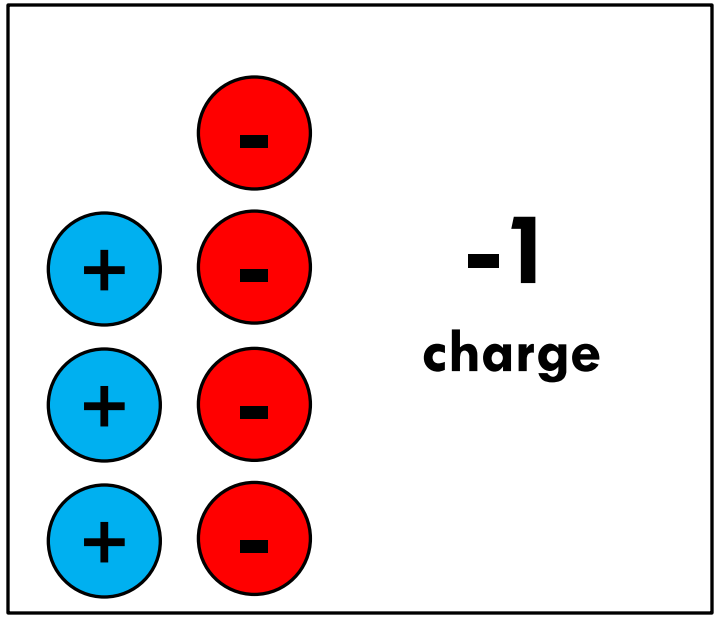
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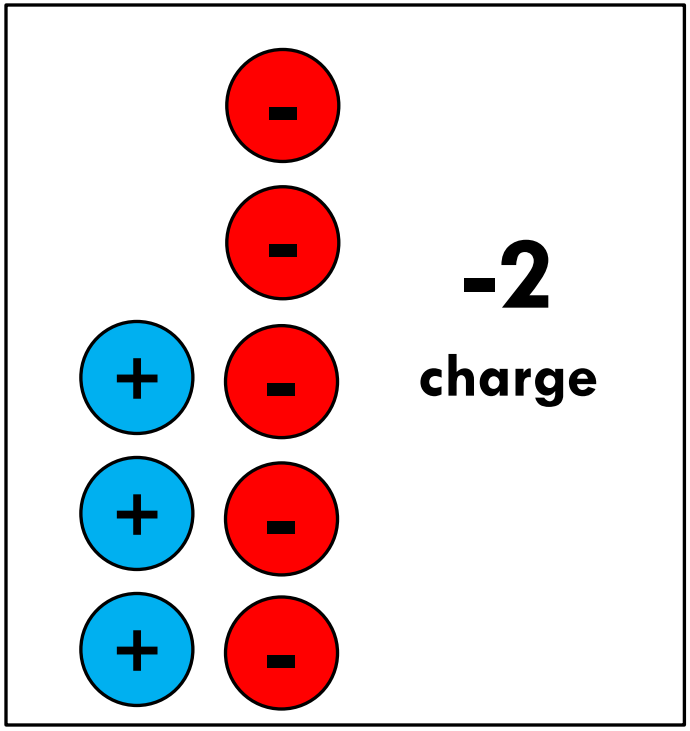
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charge

IONS!

Oxygen	Sodium
O^{-2}	Na^{+1}
Negative	Positive
Anion	Cation
Gained electrons	Took away electrons

Need some extra explanation?

What are Isotopes Video

https://www.youtube.com/watch?v=EboWeWmh5Pg

What are Ions Video

https://www.youtube.com/watch?v=WWc3k2723IM

LINK TO YOUTUBE VIDEO OF PRESENTATION

https://youtu.be/vDzHcK1MUHo