DEVELOPMENT OF ATOMIC THEORY

1. GREEKS (MR. DEMOCRITUS)

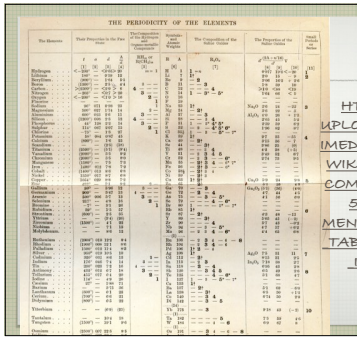
- STARTING ABOUT 500 BC
- SOMEHOW, THEY UNDERSTOOD THAT EVERYTHING IS MADE UP OF ATOMS
- ATOMS WERE SOLID BALLS OF MATTER
- THEY LEARNED BY PHILOSOPHIZING, NOT BY TESTING

1803 JOHN DALTON

- EVERYTHING IS MADE OF TINY PARTICLES CALLED ATOMS
- ALL ATOMS OF A GIVEN ELEMENT ARE IDENTICAL
- ATOMS OF EACH ELEMENT ARE DIFFERENT FROM ATOMS OF ALL OTHER ELEMENTS
- ATOMS ARE CHARACTERISTIC PROPERTIES OF MATTER (ELEMENTS)
- MR. DALTON IS QUITE A CHARACTER

ALSO: DMITRI MENDELEEV C.1869

- FIRST TO ARRANGE ELEMENTS ACCORDING TO ATOMIC MASS
- NOTICED SIMILARITIES AMONG ELEMENTS WITH SIMILAR ATOMIC MASSES
- MEASURED ATOMIC WEIGHTS BY FINDING RELATIVE MASSES OF GASES COMPARED TO HYDROGEN



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1897 JOSEPH THOMSON

- CATHODE RAY TUBE EXPERIMENT
- DISCOVERED THE ELECTRON--A NEGATIVELY CHARGED SUBATOMIC PARTICLE FOUND IN "ALL" ATOMS
- TOM RIDDLE--ELECTRIC

1911 ERNEST RUTHERFORD

- GOLD FOIL EXPERIMENT
- DISCOVERED A POSITIVE ELECTRIC CHARGE IN THE NUCLEUS OF AN ATOM
- "PROTON"
- FORD PROTON

ALSO: 1913 NIELS BOHR

- DISCOVERED THAT ELECTRONS LIE IN "ENERGY LEVELS"

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ALSO: 1926 HEISENBERG

- DISCOVERED ELECTRON "ORBITALS"
- THE EXACT LOCATION OF AN ELECTRON CAN NEVER BE DETERMINED, BUT HE CAME UP WITH A MATH FORMULA THAT SHOWED THE HIGH PROBABILITY AND LOW PROBABILITY AREAS TO FIND AN ELECTRON

1932 JAMES CHADWICK

- BOMBARDED A SHEET OF BERYLLIUM WITH ALPHA PARTICLES
- DISCOVERED THE NEUTRON
- JIMMY NEUTRON

1964 MURRAY GELL-MANN

- THERE ARE PARTICLES EVEN SMALLER THAN PROTONS NEUTRONS AND ELECTRONS

- HE CALLED THEM QUARKS.
- 6 "FLAVORS" OF QUARKS: UP, DOWN, TOP, BOTTOM, CHARM, AND STRANGE
- QUIRKY NAME = QUARKY

ATOMIC THEORY 2014:

- PROTONS ARE POSITIVELY CHARGED PARTICLES WHICH ARE LOCATED IN THE NUCLEUS
- NEUTRONS ARE NEUTRALLY CHARGED PARTICLES WHICH ARE LOCATED IN THE NUCLEUS
- ELECTRONS ARE NEGATIVELY CHARGED PARTICLES WHICH REVOLVE AROUND THE NUCLEUS

PROTONS, NEUTRONS, ELECTRONS

Particle	Charge	Location	Atomic Mass
Proton	Positive	Nucleus	One
Neutron	None	Nucleus	One
Electron	Negative	Clouds Around Nucleus	1/1836

ATOMIC THEORY 2014:

- NUCLEUS: THE CENTER OF AN ATOM, CONSISTS OF PROTONS AND NEUTRONS
- ENERGY LEVELS (AKA ELECTRON CLOUDS, AKA SHELL): REGIONS WHERE ELECTRONS ARE LOCATED

ATOMIC THEORY 2014

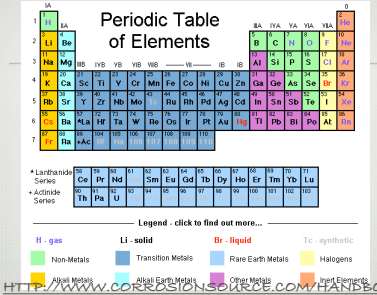
- ATOMIC MASS: (OR ATOMIC WEIGHT) = # OF NEUTRONS AND PROTONS IN AN ATOM
- MASS NUMBER: = ATOMIC MASS ROUNDED TO NEAREST WHOLE NUMBER
- ATOMIC NUMBER: = # OF PROTONS IN AN ATOM
- ISOTOPES: ATOMS OF THE SAME ELEMENT THAT HAVE A DIFFERENT NUMBER OF NEUTRONS

ATOMIC THEORY 2014:

- ☐ PERIODIC TABLE: MENDELEEV'S ARRANGEMENT OF THE ELEMENTS
- ☐ PERIODS: HORIZONTAL ROWS ON PERIODIC TABLE
- ☐ GROUPS (AKA FAMILIES): VERTICAL COLUMNS ON THE PERIODIC TABLE. ELEMENTS IN THE SAME GROUP TEND TO HAVE PHYSICAL AND CHEMICAL PROPERTIES IN COMMON

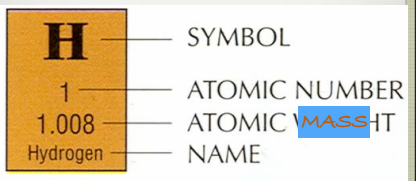
ATOMIC THEORY 2014

- ☐ ION: AN ATOM WITH AN ELECTRIC CHARGE, SINCE IT HAS A DIFFERENT NUMBER OF PROTONS AND ELECTRONS



HTTP://WWW.CORROSIONSOURCE.COM/HANDBOOK/PERIODIC/PERIODIC_TABLE.GIF

ATOMIC THEORY 2014



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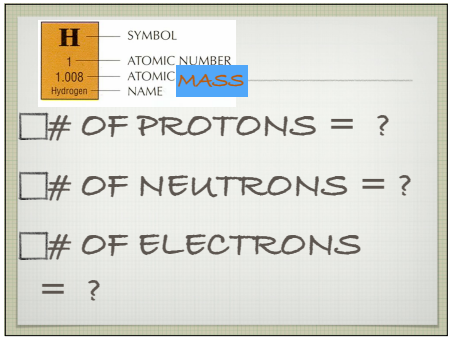
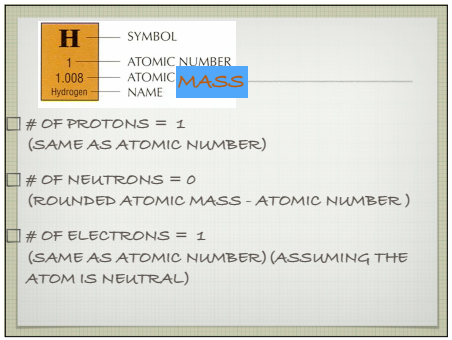
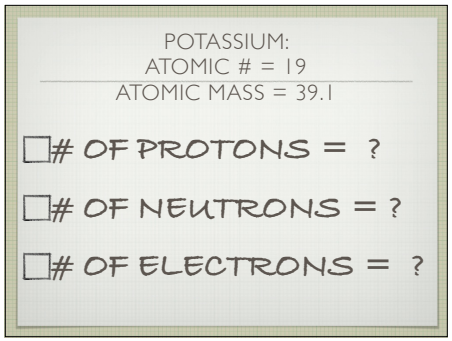
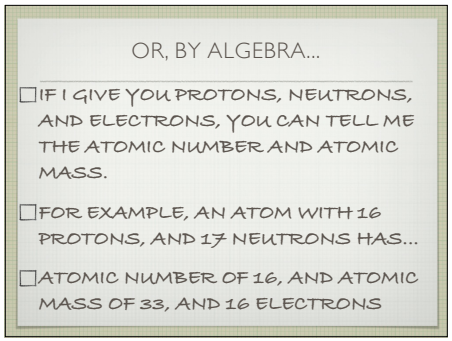

H
1
1.008
Hydrogen
SYMBOL
ATOMIC NUMBER
ATOMIC MASS
NAME
OF PROTONS = ?
OF NEUTRONS = ?
OF ELECTRONS = ?


H
1
1.008
Hydrogen
SYMBOL
ATOMIC NUMBER
ATOMIC MASS
NAME
OF PROTONS = 1
(SAME AS ATOMIC NUMBER)
OF NEUTRONS = 0
(ROUNDED ATOMIC MASS - ATOMIC NUMBER)
OF ELECTRONS = 1
(SAME AS ATOMIC NUMBER) (ASSUMING THE ATOM IS NEUTRAL)


POTASSIUM:
ATOMIC # = 19
ATOMIC MASS = 39.1
OF PROTONS = ?
OF NEUTRONS = ?
OF ELECTRONS = ?


OR, BY ALGEBRA...
IF I GIVE YOU PROTONS, NEUTRONS, AND ELECTRONS, YOU CAN TELL ME THE ATOMIC NUMBER AND ATOMIC MASS.
FOR EXAMPLE, AN ATOM WITH 16 PROTONS, AND 17 NEUTRONS HAS...
ATOMIC NUMBER OF 16, AND ATOMIC MASS OF 33, AND 16 ELECTRONS

FURTHERMORE...

- IF YOU ADD ONE PROTON TO A NUCLEUS, THE ATOM BECOMES SOMETHING ELSE. YOU CAN IDENTIFY AN ELEMENT BASED ON HOW MANY PROTONS IT HAS.
- IF YOU ADD ONE NEUTRON TO A NUCLEUS, THE ATOM IS THE SAME ELEMENT, JUST A DIFFERENT ISOTOPE.
- IF YOU ADD A PROTON, AND NOT AN ELECTRON, YOU HAVE A POSITIVE ION.
- IF YOU ADD AN ELECTRON, AND NOT A PROTON, YOU HAVE A NEGATIVE ION.

CHEMICAL BONDS

- ATOMS OFTEN BOND TOGETHER BY SHARING THEIR OUTERMOST LAYER OF ELECTRONS
- THESE "CHEMICAL BONDS" CREATE NEW SUBSTANCES, AND THE PROPERTIES OF THE ELEMENTS IN THE BOND ARE COMPLETELY CHANGED

CHEMICAL BONDS

- FOR EXAMPLE H_20 ATOMS HAVE TWO ATOMS OF HYDROGEN, AND ONE OF OXYGEN, BOTH OF WHICH ARE GASES AT ROOM TEMPERATURE. HOWEVER, THANKS TO THE CHEMICAL BOND, A COMPLETELY DIFFERENT SUBSTANCE WITH DIFFERENT PROPERTIES IS FORMED.

MR. MARTIN'S 1ST LAW OF CHEMISTRY--BY SABRINA

- IF YOU ADD ONE PROTON TO A NUCLEUS, THE ATOM BECOMES SOMETHING ELSE. YOU CAN IDENTIFY AN ELEMENT BASED ON HOW MANY PROTONS IT HAS.

MR. MARTIN'S 2ND LAW OF CHEMISTRY--BY SABRINA

- THESE "CHEMICAL BONDS" CREATE NEW SUBSTANCES, AND THE PROPERTIES OF THE ELEMENTS IN THE BOND ARE COMPLETELY CHANGED

MR. MARTIN'S 3RD LAW OF CHEMISTRY--BY SABRINA

- FOR EXAMPLE H_2O ATOMS HAVE TWO ATOMS OF HYDROGEN, AND ONE OF OXYGEN, BOTH OF WHICH ARE GASES AT ROOM TEMPERATURE. HOWEVER, THANKS TO THE CHEMICAL BOND, A COMPLETELY DIFFERENT SUBSTANCE WITH DIFFERENT PROPERTIES IS FORMED.

CHEMICAL BONDS

- THERE IS A RELATIONSHIP BETWEEN THE NUMBER OF ELECTRONS IN AN ATOMS OUTERMOST ELECTRON LEVEL, AND ITS CHEMICAL PROPERTIES

PROPERTIES ARE BASED ON:

- ELEMENTS IN THE SAME FAMILY OFTEN DISPLAY SIMILAR CHEMICAL PROPERTIES BECAUSE THEY HAVE THE SAME NUMBER OF ELECTRONS IN THEIR OUTERMOST SHELL

CHEMICAL BONDS

- FOR EXAMPLE, ATOMS WITH EXACTLY ONE ELECTRON IN THEIR OUTERMOST SHELL TEND TO BOND WITH ATOMS WHICH ARE ONE ELECTRON SHORT OF A "FULL" OUTER SHELL

P. 446-447

- FOR EXAMPLE, ATOMS OF ELEMENTS IN THE LEFTERNMOST COLUMN HAVE ONE ELECTRON IN THEIR OUTERMOST SHELL (LITHIUM, SODIUM, POTASSIUM, ETC.)
- AND ELEMENTS IN THE SECOND RIGHTERNMOST COLUMN NEED ONE ELECTRON IN THEIR OUTERMOST SHELL (FLUORINE, CHLORINE, BROMINE, ETC.)
- SINGLE ATOMS OF THESE ELEMENTS OFTEN COMBINE WITH EACH OTHER, AND SHARE THEIR OUTERMOST CLOUD OF ELECTRONS

NEXT: THE HARDEST PART: ELECTRON LEVELS

- EACH ELECTRON GOES INTO A SPECIFIC LEVEL (CLOUD)
- 1ST ELECTRON GOES TO 1ST CLOUD
- 2ND ELECTRON GOES TO 1ST CLOUD
- 3RD ELECTRON GOES TO 2ND CLOUD
- 4TH ELECTRON GOES TO 2ND CLOUD

ELECTRON CHART

Electron #	Electron Level	Shape
1 and 2	1	s
3 and 4	2	s
5 thru 10	2	p
11 and 12	3	s
13 thru 18	3	p
19 and 20	4	s
21 thru 30	3	d
31 thru 36	4	p

1s, 2s, 2p, 3s, 3p, 4s, 3d, 4p, 5s, 4d, 5p, 6s, 4f, 5d, 6p, 7s, 5f, 6d, and 7p; per http://en.wikipedia.org/wiki/Electron_configuration on 5/6/09
1s, 2s, 2p, 3s, 3p, 4s, 3d, 4p, 5s, 4d, 5p, 6s, 4f, 5d, 6p, 7s, 5f, 6d, 7p

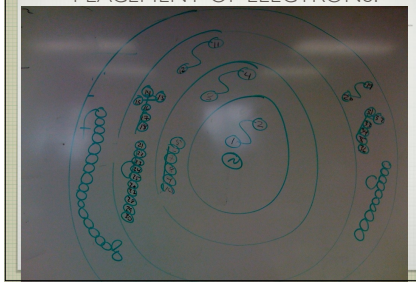
FILLING ORDER:

- 1s, 2s, 2p, 3s, 3p, 4s, 3d, 4p, 5s, 4d, 5p, 6s, 4f, 5d, 6p, 7s, 5f, 6d, 7p
- s=2; p=6; d=10; f=14; g=18
- per http://en.wikipedia.org/wiki/Electron_configuration on 5/6/09

ELECTRON LEVELS
BY THE WAY, THE FORMULA IS: $2L^2$

Level	# of Electrons it can Hold When Full	Shapes it Holds
1	2	s
2	8	s, p
3	18	s, p, d
4	32	s, p, d, f
5	50	s, p, d, f, g
6	72	s, p, d, f, g, ?

PLACEMENT OF ELECTRONS:



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