

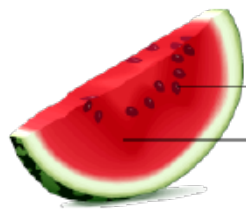

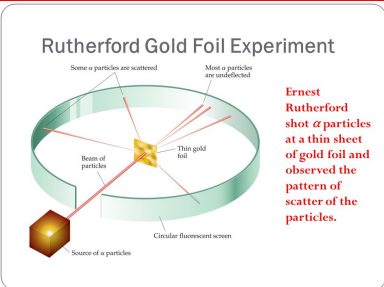
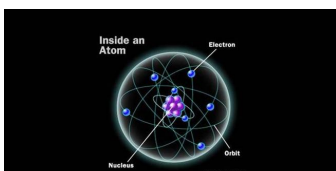
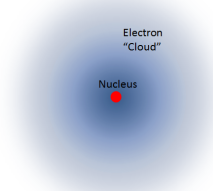
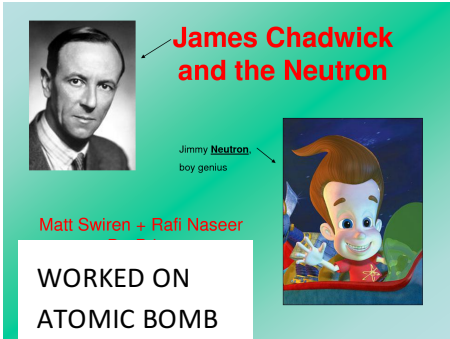
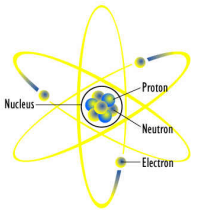


CHAPTER 3 ELEMENTS & PERIODIC TABLE

LESSON 1: INTRO TO ATOMS...page 72

→ A speck of dust could contain 10 million billion atoms.....WOW!

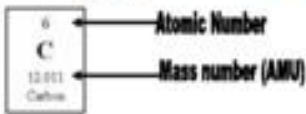
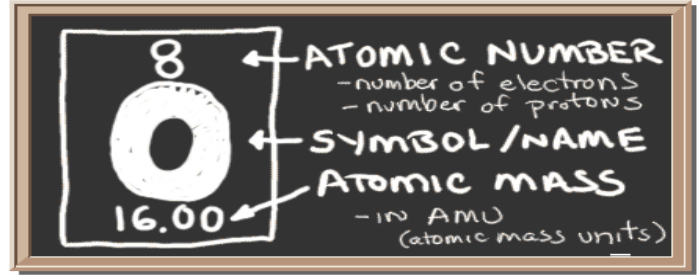
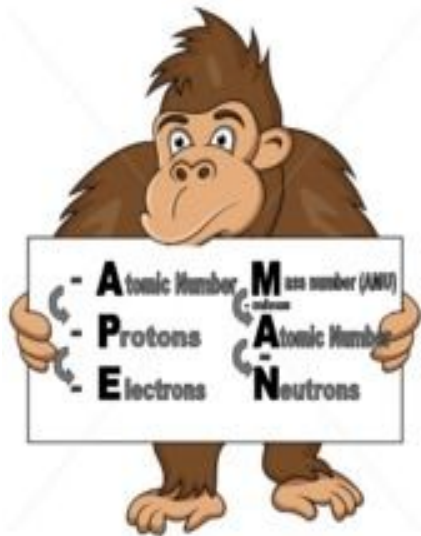
SCIENTIST	YEAR	DISCOVERY
DEMOCRITUS	430 B.C.	<ul style="list-style-type: none"> FATHER OF THE ATOM Said, "Matter was made of small pieces that couldn't be cut apart.. called <i>atomos</i> "uncuttable" 
JOHN DALTON	1808	<ul style="list-style-type: none"> Said, "Atoms are like smooth hard balls that couldn't be broken into smaller pieces." (Ex: pool ball) He created ...DALTON'S ATOMIC THEORY (See pg. 73)  <p>Dalton 1803-1805</p>
J.J. THOMSON "Plum Pudding Model"	1897	 <ul style="list-style-type: none"> Discovered ELECTRONS (negatively charged particles) Thought negative & positive charges canceled each other out. His model looked like watermelon w/ seeds scattered throughout or inside of blueberry muffin. 
ERNEST RUTHERFORD "Nuclear Model"	1911	<ul style="list-style-type: none"> Discovered PROTONS (positively charged particles) in 1920 & NUCLEUS of an atom Gold Foil Experiment: Discovered an atom is mostly empty space but has a positive charge at the center.  <p>Rutherford Gold Foil Experiment</p> <p>Ernest Rutherford shot α particles at a thin sheet of gold foil and observed the pattern of scatter of the particles.</p>
NIELS BOHR "Planetary Model"	1913	<ul style="list-style-type: none"> Electrons ARE IN SPECIFIC ORBITS around nucleus w/ fixed energy (EX: Like planets orbiting the sun)  <p>BOHR MODEL OF THE ATOM "The Planetary Model of the Atom"</p>

Electron CLOUD MODEL	1920'S	<ul style="list-style-type: none"> Model was changed.... Electrons DO NOT orbit like planets... but MOVE IN A "CLOUD-LIKE" REGION OUTSIDE OF NUCLEUS. <ul style="list-style-type: none"> Energy Level = specific amount of energy an electron has.... Electrons at different levels are found in different places.  <p>Note: Not to Scale! M. Sraessler 2013</p>
JAMES CHADWICK	1932	<ul style="list-style-type: none"> Discovered the NEUTRON = (NO charge... neutral) 
MODERN atomic THEORY "Quantum Model"	Present day	<ul style="list-style-type: none"> Nucleus holds PROTONS & NEUTRONS ELECTRONS are in a cloud around nucleus 

- PROTONS** → POSITIVE CHARGE → SHOWN BY (P+) SIGN
- ELECTRONS** → NEGATIVE CHARGE → SHOWN BY (E-) SIGN → SUPER TINY...VERY LITTLE MASS
- NEUTRONS** → NO CHARGE (NEUTRAL) → SHOWN BY (N⁰) SIGN

The RULEZ.....

- #1 → Atomic number is the SAME as the # of Protons
- #2 → # of Protons is the SAME as the # of Electrons
- #3 → Atomic mass = the number of Neutrons + number of Protons
- #4 → Atomic mass - Atomic number = number of Neutrons
(never a negative number)



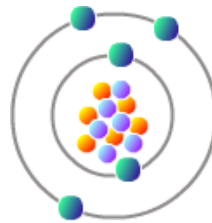
ISOTOPES

1. **ISOTOPE** = atoms with same number of protons & different numbers of neutrons

a. Examples of Isotopes (Like different versions of Pepsi soda)

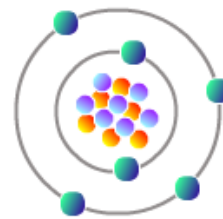
- i. Carbon -12 (has 6 protons & 6 neutrons)
- ii. Carbon- 13 (has 6 protons BUT has 7 neutrons)
- iii. Carbon - 14 (has 6 protons BUT has 8 neutrons)

b. Isotopes are identified by their **mass number** (12, 13, 14, etc.)



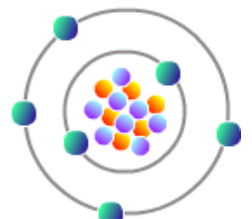
Carbon
 ● 6 Protons
 ● 6 Neutrons

Nuclear number
 = 6 + 6
 = 12



Carbon-13
 ● 6 Protons
 ● 7 Neutrons

Nuclear number
 = 6 + 7
 = 13



Carbon-14
 ● 6 Protons
 ● 8 Neutrons

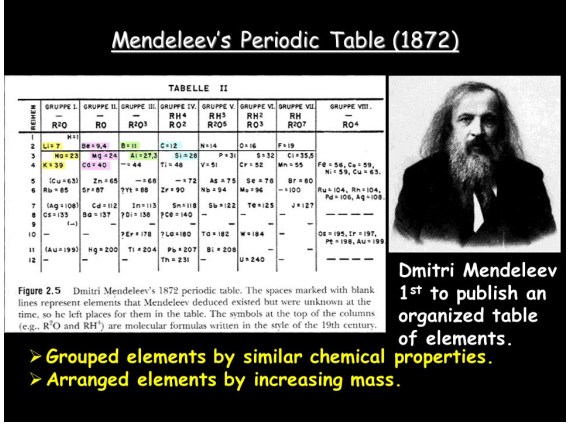

Nuclear number
 = 6 + 8
 = 14

→ Remember.. to get atomic mass you ADD protons + neutrons

CHAPTER 3 LESSON 2: ORGANIZING THE ELEMENTS...

Page 80

**** There was only 63 elements discovered by 1869.. then Mendeleev made a great discovery.**

DMITRI MENDELEEV	HENRY MOSELEY
<div style="text-align: center; border: 1px solid black; padding: 5px; margin-bottom: 10px;"> Mendeleev's Periodic Table (1872) </div>  <p>Figure 2.5 Dmitri Mendeleev's 1872 periodic table. The spaces marked with blank lines represent elements that Mendeleev deduced existed but were unknown at the time, so he left places for them in the table. The symbols at the top of the columns (e.g., RO and RH) are molecular formulas written in the style of the 19th century.</p> <ul style="list-style-type: none"> > Grouped elements by similar chemical properties. > Arranged elements by increasing mass. <ol style="list-style-type: none"> 1. Noticed that a pattern of properties appeared when he arranged the elements. 2. He arranged elements according to ATOMIC MASS 3. He found that the properties of the elements repeated... so he grouped them in columns 4. 1869 he created FIRST periodic table 	<p style="text-align: center; color: red; font-weight: bold; font-size: 1.2em;">HENRY MOSELEY</p> <p>*Moseley noticed some elements didn't "Fit" in w/ their family grouping</p> <p>Early 1900's he improved the periodic table.. arranged by ATOMIC NUMBER.</p> <p style="text-align: center; color: blue; font-weight: bold; font-size: 1.2em;">Henry Moseley</p> <p style="text-align: center; color: blue; font-style: italic;">In 1913, through his work with X-rays, he determined the actual nuclear charge (atomic number) of the elements*. He rearranged the elements in order of increasing atomic number.</p> <p style="text-align: center; color: blue; font-style: italic;">*"There is in the atom a fundamental quantity which increases by regular steps as we pass from each element to the next. This quantity can only be the charge on the central positive nucleus."</p> <p style="text-align: center; color: blue; font-weight: bold; font-size: 1.2em;">1887 - 1915</p> 

WHAT THE HECK'S ON THE PERIODIC TABLE????

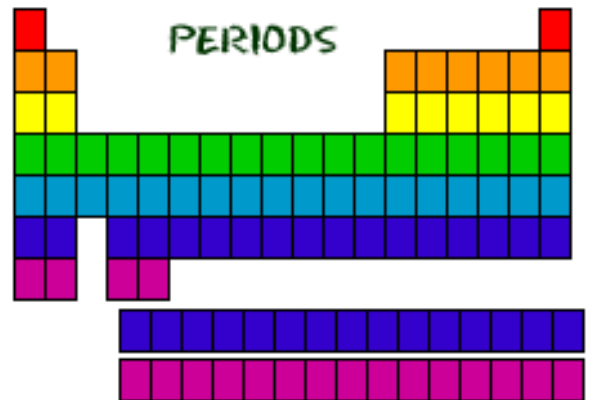
- A. **Atomic Number** = the number of PROTONS in the NUCLEUS
- B. **Chemical Symbol** = letter (s) that represent the element
- C. **Atomic Mass**= is the number of PROTON + NEUTRONS in the NUCLEUS
- D. **Element Name**
- E. **It's state (Solid/Liquid/Gas)**

THERE ARE 118 ELEMENTS ON THE PERIODIC TABLE!!!!

- Atomic Numbers INCREASE from left → right
- Color coded to show METALS vs NONMETALS vs METALLOIDS
- An elements properties can be predicted from its location in the periodic table

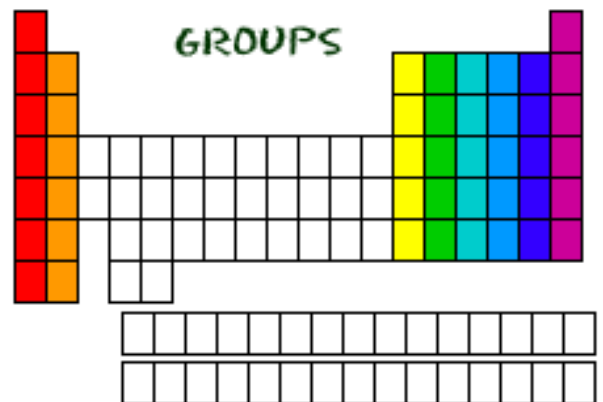
PERIODS (ROWS)

1. Another name for ROWS on periodic table
2. There is 7 rows
3. Metals are on the left... Metalloids in middle... Nonmetals on the right
→ Remember.. you put a period at the end of a sentence... same direction as periods on table.



GROUPS (FAMILIES)

1. Another name for COLUMNS or FAMILIES on table
2. There is 18 groups.. elements in these families act alike



CHAPTER 3 LESSON 3: METALS... page 88

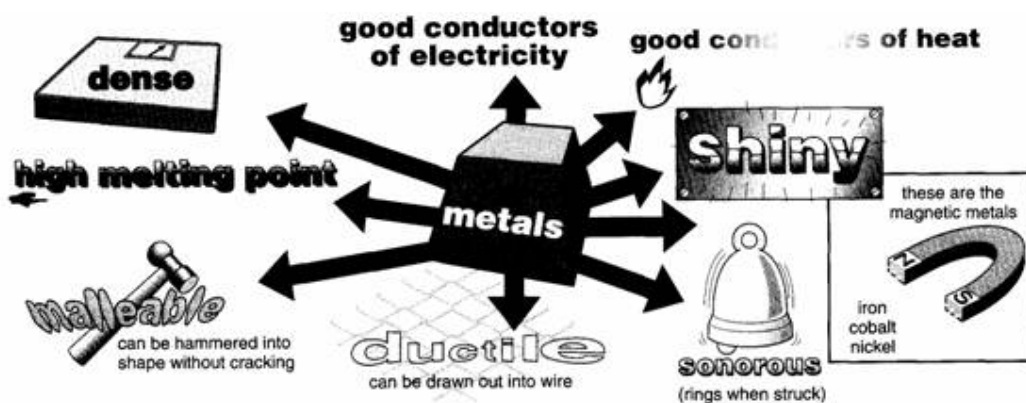
Metals = elements that are:

1. GOOD conductors of heat & electricity
2. Bendable
3. Shiny
4. Most elements on periodic table are metals

5. Physical

Properties of Metals:

- Luster**= shiny & reflective
- Malleable** = can be hammered or rolled into flat sheets or shapes
- Ductile** = can be pulled into long wires (Ex: copper is malleable & ductile)
- Thermal Conductivity** = object can transfer heat (Ex: cooking pan)
- Electrical Conductivity** = object can carry electric current



→ **Mercury (Hg) is the ONLY metal that is a LIQUID at room temp.**

6. Chemical Properties of Metals:

- Reactivity** = ease & speed that an element reacts or combines w/ other elements (Ex: Sodium (Na) reacts strongly with water)
- Corrosion** = breakdown of a metal due to chemical reaction (rxn) in the environment (Ex: iron (Fe) chain rusting)



<p>ALKALI METALS</p>	<p>GROUP 1</p>	<ul style="list-style-type: none"> • Most reactive elements on Periodic Table... get more explosive the further down the column you go • Low densities • Low melting points • FOUND IN: Potassium= fireworks & bananas, Lithium = batteries, NaCl=table salt
<p>ALKALINE EARTH METALS</p>	<p>GROUP 2</p>	<ul style="list-style-type: none"> • Harder, Denser & melt at higher temps than alkali's • Not as reactive as alkali's. • FOUND IN: Calcium = in your bones emeralds, chlorophyll of plants, Tums antacid
<p>TRANSITION METALS</p>	<p>GROUPS 3-12</p>	<ul style="list-style-type: none"> • Hard, shiny solid, high m.p. & high densities, good conductors
<p>METALS IN MIXED GROUPS</p>	<p>ANY METALS FOUND IN GROUPS 13-16 FIT HERE</p>	<ul style="list-style-type: none"> • Only some are metals • Aluminum = bicycle frames, pop cans, baseball bats • Tin= protects steel from corrosion in canned food, • Lead= once used in paint & water pipes, now in auto batteries
<p>LANTHANIDES</p>	<p>TOP ROW BELOW TABLE</p>	<ul style="list-style-type: none"> • Neodymium = laser light for surgery, cutting metals & laser range finders
<p>ACTINIDES</p>	<p>BOTTOM ROW BELOW TABLE</p>	<ul style="list-style-type: none"> • Most are made in laboratories • The Transuranium elements are in this family.
<p>TRANSURANIUM ELEMENTS</p>	<p>FOLLOW URANIUM ON THE TABLE</p>	<ul style="list-style-type: none"> • Made by crashing nuclear particles into each other by using particle accelerators (Used for all elements w/ atomic numbers greater than 95)...Ex: Plutonium • Np, Pu, Am, Cm, Bk, Cf, Es, Fm, Md, No

Nonmetal = lacks most of the properties of a metal

1. **Physical Properties** of Nonmetals:
 - a. Poor conductors of electric current & heat
 - b. Dull & brittle
 - c. Most are gases at room temp
2. **Chemical Properties** of Nonmetals:
 - a. Usually gain or share electrons when they react w/ other atoms

CARBON FAMILY	GROUP 14	<ul style="list-style-type: none">• Only Carbon is a nonmetal in this family.• All living or once living things contain = Carbon• Diamonds are pure carbon
NITROGEN FAMILY	GROUP 15	<ul style="list-style-type: none">• Only Nitrogen & Phosphorus are nonmetals in this family.• Nitrogen is 78% earth's atmosphere• Arsenic is poison that killed Napoleon
OXYGEN FAMILY	GROUP 16	<ul style="list-style-type: none">• Nonmetals are oxygen, sulfur & selenium• Oxygen to breathe,• Sulfur makes rubber bands and auto tires
HALOGEN FAMILY	GROUP 17	<ul style="list-style-type: none">• Nonmetals are fluorine, chlorine, bromine & iodine• Chlorine in pools• Fluorine in toothpaste & nonstick coating on pans
NOBLE GASES	GROUP 18	<ul style="list-style-type: none">• They are stable & don't need to combine w/ other elements.• Helium in balloons• Neon in signs
HYDROGEN	ALL BY ITSELF	<ul style="list-style-type: none">• Hydrogen has NO family• Makes up more than 90% of atoms in universe.

Metalloids = have some properties of metals & some of nonmetals

1. All solids at room temp
2. Brittle, hard & somewhat reactive
3. **Silicon**= is most common - found in solar panels & glass
4. Can conduct electric current
- a. SEMICONDUCTOR=

Periodic Table of the Elements

substances that can conduct electric current under some conditions and not under others (Ex: to make computer chips, lasers, etc.)

What are Metalloids?

Location

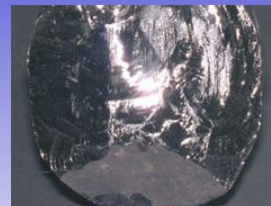
- Border the zigzag line/staircase on the periodic table

silicon is the most common

- Found in semi conductors
- Examples: computers, cell phone

Physical Properties

- have properties of both metals and non-metals



14
Si
28.086

Image taken from:
<http://library.thinkquest.org/C0115065/bios.shtml>



5
B
10.811

Image taken from:
<http://library.thinkquest.org/C0115065/bios.shtml>