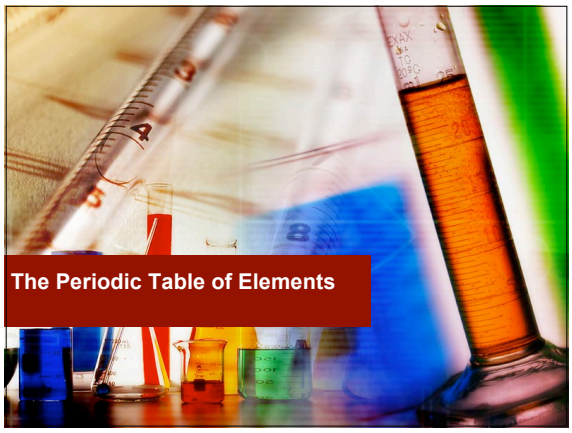
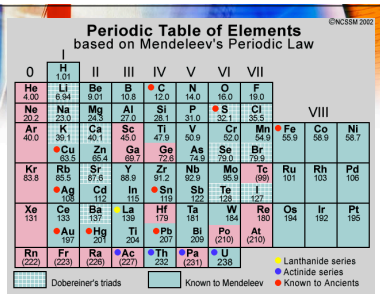



## 1. And now a song about elements

## 2. And now Bill Nye: Atoms

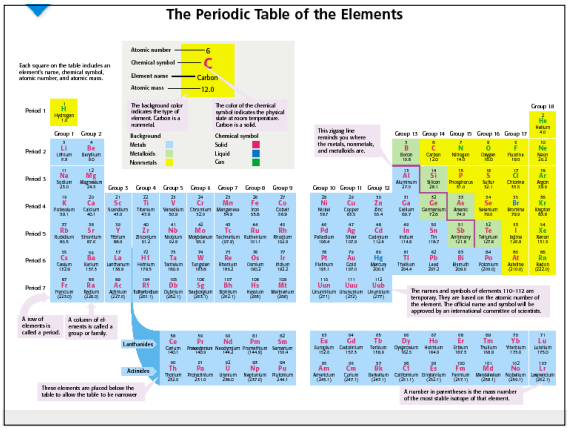
## Dmitri Mendeleev (1834-1907)

- A Russian chemist attempted to organize the elements based on information such as density, appearance, atomic mass, and melting point.
- After much work he determined that there was a **repeating pattern** to the properties when the elements were arranged in order of increasing atomic mass.

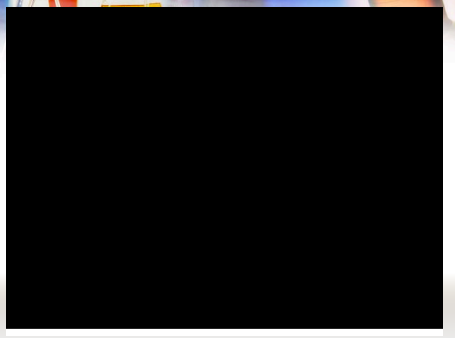



- In this order, certain chemical properties of the elements were "**periodic**" meaning that they had a regular repeated pattern.
- There were still some missing elements, but he predicted that those were elements yet to be discovered.

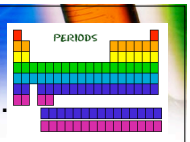
- In 1914 Henry Moseley determined that the elements should be arranged by the number of **protons** - the **atomic number** - and the periodic table was rearranged using this method, which greatly improved the arrangement of elements.



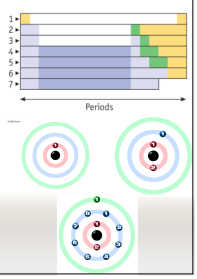

# 3. The Periodic Table & Elements

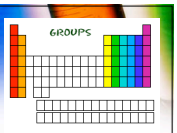


## You've got your Periods..




- Periods = **rows** From left to right
- What do elements in a row have in common?
  - the same number of **electron shells**
- Every element in Period 1 (1st row) has 1 shell for its electrons (H & He)
- All of the elements in period 2 have two shells for their electrons.
- It continues like this all the way down the table
- The elements in a row become less metallic from left to right

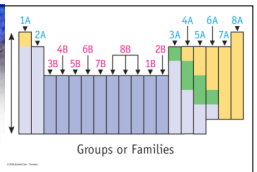


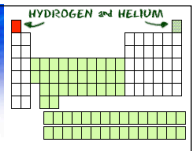

## And You've got your groups

- Column = **group** = **families**
- What do elements in a group have in common?
  - same number of **valence electrons** (electrons in the outer shell)
- Every element in group 1 (1st column) has 1 valence electron
- Every element in group 2 has 2 valence electrons.
- In fact, if you know the group's number, you automatically know how many valence electrons it has!


## Group Labels




- Labeling the groups can be confusing because the rules change with the middle transition elements.
- The transition elements get grouped together as the "B" elements, or groups #1B - 8B.
- All of the other elements are "A" elements, with groups #1A - 8A.
- Using this labeling system will tell you exactly how many valence electrons are in the atoms.
- However, sometimes the groups are just labeled #1-18.




## Two at the Top

- **Hydrogen** (H) and **helium** (He) are special elements.
- Hydrogen can have the talents and electrons of two groups, one and seven.
- Sometimes it is missing an electron, and sometimes it has an extra.
- Helium is different from all of the other elements.
- It can only have two valence electrons
- Even though it only has two, it is still grouped with elements that have eight.

## Hydrogen: stands alone

- Gas,
- reactive,
- 1 electron in outer level.
- Hydrogen does not match properties of any single group so it is placed above Group 1.
- It can give it's electron away with ionic bonding, or share it's electron in covalent bonding

## 4. Hydrogen Reaction

### Hydrogen Balloon Explosion

REACTION ONLY

THE PERIODIC TABLE OF VIDEOS
By Brady Haran
The University of Nottingham

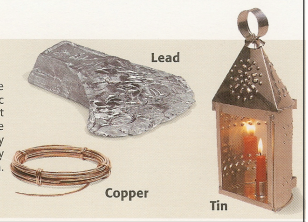
Periodic Table of Videos: http://www.periodicvideos.com/

## Finding your way around the Periodic Table:

3 classes of elements

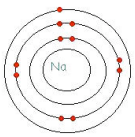
### Metals

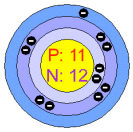
**Metals** are elements that are shiny and are good conductors of thermal energy and electric current. They are easily shaped into different forms because they are *malleable* (they can be hammered into thin sheets) and *ductile* (they can be drawn into thin wires). Iron has many uses in building and automobile construction. Copper is used in wires and coins.



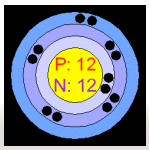

Atoms of most metals have few electrons in their outer energy level

electron



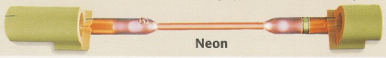

Sodium with 1 extra electron




Magnesium with 2 extra electrons

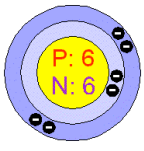

### Nonmetals

**Nonmetals** are elements that are dull (not shiny) and that are poor conductors of thermal energy and electric current. Solid nonmetals tend to be brittle and unmalleable. Few familiar objects are made of only nonmetals. The neon used in lights is a nonmetal, as is the graphite (carbon) used in pencils.

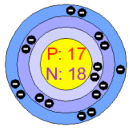



Atoms of most nonmetals have an almost complete set of electrons in their outer level






Carbon: In need of 4 electron to have a full outer level

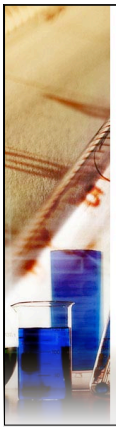


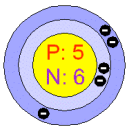

Chlorine only needs 1 electron to have a full outer energy shell

## Metalloids

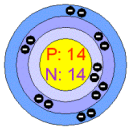
**Metalloids,** also called semiconductors, are elements that have properties of both metals and nonmetals. Some metalloids are shiny, while others are dull. Metalloids are somewhat malleable and ductile. Some metalloids conduct thermal energy and electric current well. Other metalloids can become good conductors when they are mixed with other elements. Silicon is used to make computer chips. However, other elements must be mixed with silicon to make a working chip.


**Atoms of metalloids have about a half-complete set of electrons in their outer energy level**

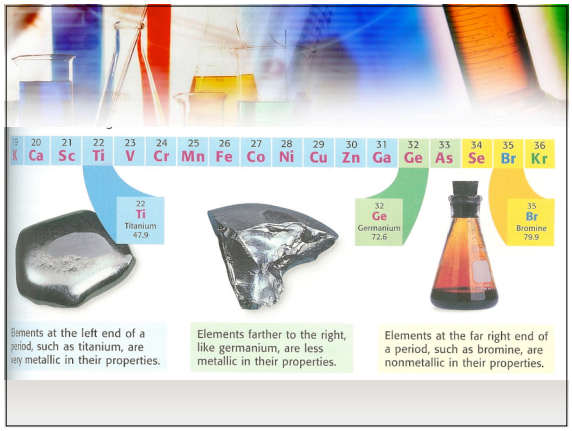





Boron:
In need of
5 electrons

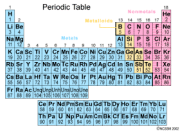



Silicon:
In need of 4
electrons



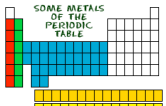

## Metals, Metalloids, & Nonmetals

- Another pattern we find on the periodic table is that all of the metals are grouped together on the left & the nonmetals are on the right.
- The metalloids fall in between, near the zigzag line.
- This trend isn't a coincidence.
- The number of **valence electrons**, or electrons in the outer shell, determines how an element acts.



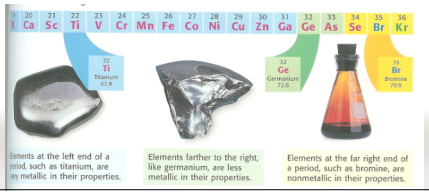

## Metals, Metalloids, & Nonmetals

- For example, all of the metals have **few** valence electrons.
- This causes them to possess metallic properties such as, conductivity & reactivity.
- Conversely, the nonmetals on the right of the periodic table have **almost** complete sets of electrons in their outer level.
- Therefore, they possess nonmetallic traits such as dullness, poor conductivity, and brittleness.




## Metals, Metalloids, & Nonmetals

- We can summarize all of this just by saying:
- Elements get less metallic as you move from left to right.

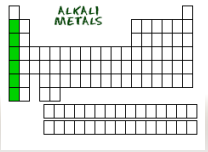


## Families Stick Together

- Scientists group families of elements by their **chemical properties**.
- Each family reacts a different way with the outside world.
- BUT, elements within a family are similar to one another.
- Metals behave differently than gases and there are even different types of metals.
- Some don't react, others are very reactive, and some are metallic.
- Let's go over the periodic table families…

## Family #1 or 1A: Alkali Metals

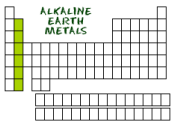
- Li , Na , K , Rb, Cs, Fr
- **Very** Reactive
- **1** valence electron




- All have ONE outer electron to lose.
- Sodium is used in street lights, and different compounds are used in detergent, paper, glass & soap.
- This makes them highly reactive, since they are looking to combine with another element to become stable and have that outer level filled and complete (or happy!).
- They are the most reactive of all metals
- These are also soft and can be cut with a knife.

## Family #2 or 2A: Alkaline Earth Metals

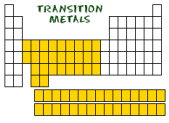
- Be, Mg, Ca, Sr, Ba, Ra
- **very** reactive, but less than alkali metals
- **2** valence electrons




- Not as reactive because it is harder to give two electrons away than just one.
- Potassium is used in fertilizer and with chloride.
- These elements are typically what are lost in perspiration which is why people buy special sport drinks that contain these elements!
- Calcium is in milk
- Magnesium is in Fireworks.

## Family #3-12 (1B-8B): **Transition** Metals

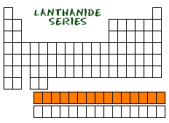
- **1-2** valence electrons
- **Less** reactive than alkaline earth metals because they don't give away their electrons as easily



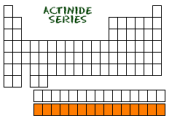

- In these "short families" the properties are very much alike.
- Most have high melting points and are hard.
- Have 1 or 2 properties like the alkali or alkaline earth families.
- Group 11 = The **Copper** Family: are the coinage metals (Cu, Ag, Au) used to make currency

## Family #3-12 (1B-8B): Transition Metals

- **Lanthanide** Series:
  - 15 elements that start with lanthanum (La) at atomic number 57 and finishing up with lutetium (Lu) at number 71
  - shiny reactive metals
  - Most found in nature

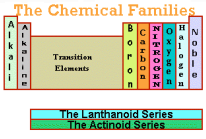



- **Actinides** Series:
  - 15 elements that start with actinium (Ac) at atomic number 89 and finishing up with lawrencium (Lr) at number 103.
  - radioactive and unstable
  - Most are man-made & not stable in nature




## Group 13: The Boron Group

- One metalloid and 4 metals
- B, Al, Ga, In, Tl
- **3** electrons in the outer energy level
- Reactive
- **Solid** at room temperature
- Most common element in this group is **aluminum**

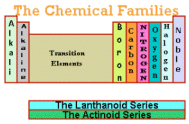



- Boron is most commonly found as borax and boric acid, which are used in cleaning compounds.
- Aluminum is the third most common element in the earth's crust. It is used as a coating agent, to prevent oxidation. It is an excellent conductor of electricity and heat and can be found in many cooking utensils.

## #14 or 4A: Carbon Family

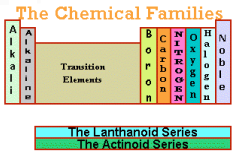
- C, Si, Ge, Sn, Pb
- 1 metal, 1 metalloid, and 2 nonmetals.
- **4** valence electrons

- No other group has a greater range of properties.
- They have the unique ability to form chainlike compounds.
- This family is incredibly important in the field of **technology**.




## #15 or 5A: Nitrogen Family

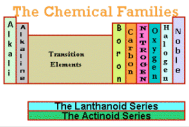
- N, P, As, Sb, Bi
- 2 nonmetals, 2 metalloids, 1 metal
- **5** valence electrons
- Reactivity varies




## #16 or 6A: Oxygen Family

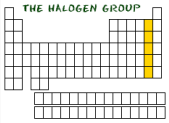
- O, S, Se, Te, Po
- 3 nonmetals, 1 metalloid, 1 metal
- **6** valence electrons
- reactive

- Most members form covalent compounds
- Must share 2 electrons with other elements to form compounds.
- Oxygen is one of the most reactive nonmetallic elements.



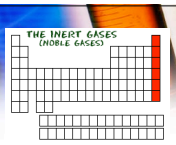

## Family #17 or 7A: Halogens

- F, Cl, Br, I, At
- **very** reactive
- **nonmetals**
- **7** valence electrons




- They are very reactive because have 7 valence electrons, this means they are ALMOST full and can combine with many elements.
- Halogen elements combine with metals to form compounds called **salts**.
- Halogen means "salt-producer".
- The combine with a metal by ionic bonding.
- They are the most reactive of the nonmetals families.
- As you move down the column, the elements get less reactive.
- A halide is when a halogen combines with another element (NaCl)

## Family #18 or 8A: Noble Gases




- He, Ne, Ar, Kr, Xe
- Nonmetals
- NON REACTIVE gases
- NO bonding with other elements
- **8** valence electrons (except He which only has 2)

- With the exception of He, these elements have 8 electrons in their outer energy level.
- Very stable
- They are **inert**, meaning they don't react with anything.
- Why? Because they're happy!
- All of these elements have full outer shells
- Colorless, odorless gases at room temperature
- Often used in neon products/neon lights
- All are found in Earth's atmosphere
- Only in laboratories can scientists force these to bond with other elements.

**5. Chemical Music Video**

# Elemental Funkiness

Music & Lyrics © 2005, Mark Rosengarten

## And now a word from Brainpop

- Brainpop

Brain POP **Periodic Table of Elements Quiz** elaine

SCORE: 10/10

1. What are the horizontal rows within the periodic table called?
(A) Periods
B. Groups
C. Elements

2. What are the vertical columns within the periodic table called?
A. Periods
(B) Groups
C. Molecules

3. How do you find the atomic number of an atom?
(A) The number of protons is the atomic number
B. The number of neutrons is the atomic number
C. The number of electrons is the atomic number

4. Elements within the same group contain the same:
A. Number of protons
(B) Number of electrons in their outer shells
C. Rich, satisfying flavor

5. What are noble gases?
A. Gases that react with every other element
(B) Elements that don't react with other elements
C. Gases that react with most, but not all, other elements

6. What is the smallest unit of a pure element?
(A) An atom
B. A neutron
C. A molecule

7. What are the three basic components of an atom?
A. Leptons, gluons, and quarks
(B) Protons, neutrons, and electrons
C. Positrons, neutrinos, and electrons

8. What is characteristic of all alkali metals and alkaline earth metals?
A. They conduct electricity very well
B. They are strong and shiny
(C) They form alkaline solutions when mixed with water

9. What is a molecule?
A. A group of particles so fragile that it decays within moments
(B) A group of atoms that have bonded by trading or sharing electrons
C. Any grouping of the same type of atom

10. What are the listings of elements in the periodic table based on?
A. The year in which they were discovered
(B) Their atomic number
C. Their atomic mass

## 6. Meet The Elements