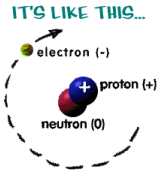
Atoms,
the Periodic Table,
Drawing Bohr Models
& more review!

- Matter has mass and takes up space.
- Atoms are basic building blocks of matter, and cannot be chemically subdivided by ordinary means.

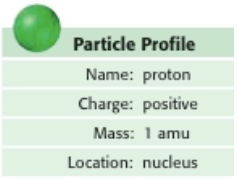
What's an atom made of?

- Even though an atom is really small, it is made of even smaller particles.
- It's basically made of 3 tiny subatomic particles:
  - **Protons**
  - **Neutrons**
  - **Electrons**

Parts of an atom:

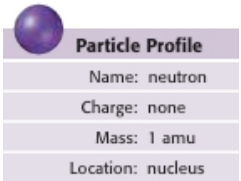


Parts of an Atom



- **Proton**
- in the nucleus
- + (positive) charge
- **1 amu**

Parts of an Atom



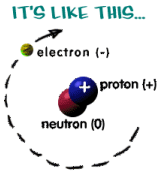
- **Neutron** in the nucleus
- 0 (no) charge
- **1 amu**

Parts of an Atom

Particle Profile
Name: electron
Charge: negative
Mass: almost zero
Location: electron clouds

- **Electron**
- in the electron cloud
- - (negative) charge
  0 amu

An Atom's Parts



- The center of an atom is called the **nucleus**.
- The nucleus contains 2 types of particles:
  - **Protons** = **positive (+)** charge
  - **Neutrons** = **no** charge, neutral
- This means the nucleus is always positive.

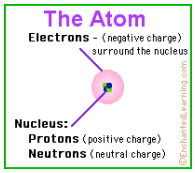
The Outside of the Atom

- Surrounding the nucleus is a cloud of electrons
- Electrons:
  - spin quickly
  - Are **negatively (-)** charged
  - are very small.
  - Have a mass of **0 AMU.**

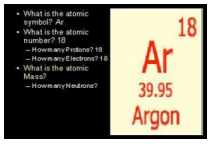
Overall Balance

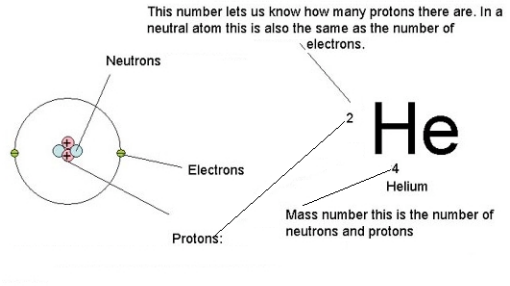
- To review, an atom is made up of 3 types of particles which are:
  - Protons (+)
  - Neutrons (0)
  - Electrons (-)
- Notice that the protons and electrons have opposite charges…what does this mean about the overall balance of an atom?
- **Nucleus (+ charge) = Electron (- charge)**

- **REVIEW: ATOMS**:
- The smallest piece of an element which still has the properties of that **element** is called an atom.
- Central core is called a **NUCLEUS** , and has a + charge.
- It is surrounded by an **Electron Cloud** which has a - charge.
- These 2 parts **balance** each other out so that the atom is electrically neutral(or has **NO** electric charge)



- The number of protons in an atom is called the **atomic number.**
- The elements in the periodic table are arranged according to **increasing atomic number.**
- It is the number of protons that determines the atomic number: H (element hydrogen) = 1.
- The number of protons in an element is constant (H=1, for 1 proton, 2= He helium, for 2 protons… and so on.
  Argon: Ar is number 18)





- This procedure NEVER changes.
- The protons are the atomic number.
- They identify the element.
- The number of protons is equal to the number of electrons so that the element is electrically stable
- (or balanced)
- The number of protons IS the **Atomic Number**

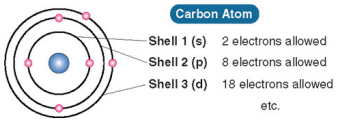
- **Mass Number** : the sum of **protons ADDED to the neutrons**.
- Mass number can vary for the same element, if the element has different numbers of neutrons.
- When this happens, these forms of an element are called **isotopes.**

- **Atomic Mass** is the weighted **AVERAGE** of the masses of ALL the natural occurring isotopes

Quick Review:

- **ATOMIC MASS**: The mass of an atom depends on the number of protons & neutrons it contains. It is the weighted AVERAGE.
- **AMU** = Atomic mass unit
- **Mass number** it is the sum of the protons + neutrons.
- **Neutrons** = mass number - atomic number
- (remember: **Atomic Number** = NUMBER of **protons**, which = NUMBER of **electrons**)

What about electrons & shells?



- The region around the nucleus is called the electron cloud.
- The electrons occupy certain energy levels.
- The farther an energy level from the nucleus, the more energy the electrons will have in it.
- 1st level = **2** electrons
- 2nd level= **8** electrons
- 3rd level = holds **8** but 18 electrons are allowed

Electron Shells

The orbits that electrons take around the nucleus fall into distinct orbital shells. These shells exist even when they are not occupied.

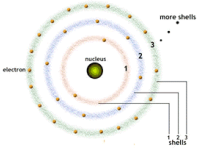
The shell nearest the nucleus (shell 1) has the tightest grip on its electron(s). The shell furthest from the nucleus has the weakest grip on its electron(s).

The number of electrons that can occupy a given shell increases with the distance of the shell from the nucleus.

The outermost occupied shell typically has fewer than its maximum number of electrons. Electrons in such under-occupied shells often pass between nearby atoms.

The number of electrons in the outer most occupied shell of an atom tends to determine many of the physical properties of substances composed of that atom.

Electrons can jump from one shell to the next but can never occupy a position between shells.



Shell 1 can hold up to 2 electrons.

Shell 2 can hold up to 8 electrons.

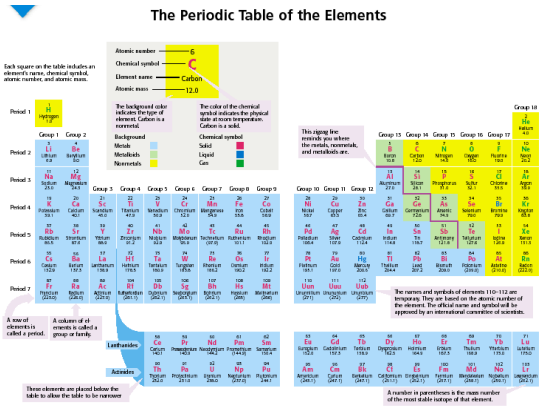
Shell 3 can hold up to up 18 electrons.

And so on.

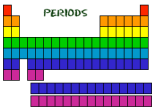
The shells fill with electrons from the inside out. That is, given the total number of electrons associated with a particular atom in its neutral state, the shells nearer to the nucleus fill to their maximums before any surplus goes to the next shell.

Example

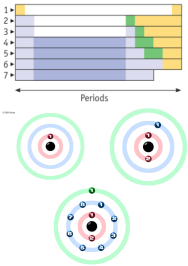
The Periodic Table Review



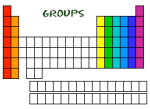
You've got your Periods…



- 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

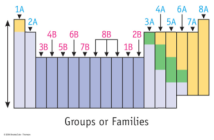


And You've got your groups



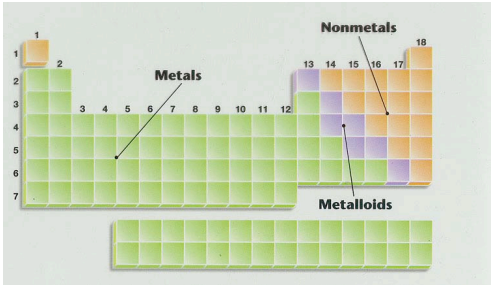
- Column = **group** = **families**
- What do elements in a group have in common?
  - **same number of** valence electrons **(electrons in the outer shell)**
- Every element in group 1 (1st column) has 1 valence electron
- Every element in group 2 has 2 valence electrons.
- In fact, if you know the group's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

Group Labels



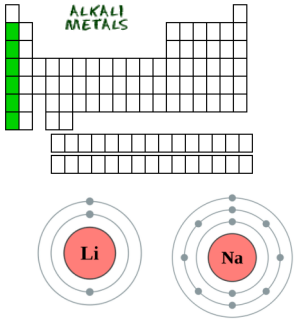
- The transition elements get grouped together as the "B" elements, or groups #1B - 8B.
- All of the other elements are "A" elements, with groups #1A - 8A.
- These are also called Families, and Families stick together!
- Using this labeling system will tell you exactly how many valence electrons are in the atoms.

Metals, Metalloids, & Nonmetals



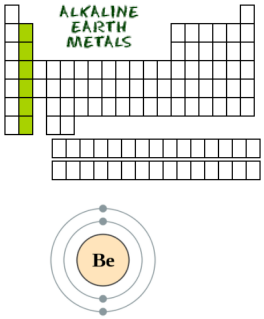
Family #1 or 1A: Alkali Metals

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



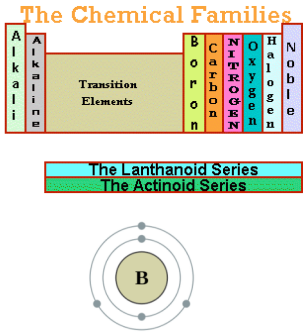
Family #2 or 2A: Alkaline Earth Metals

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



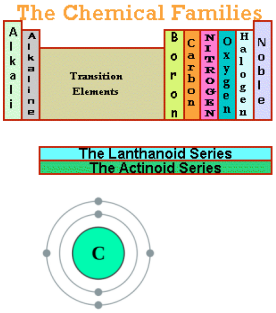
Group 13: The Boron Group

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



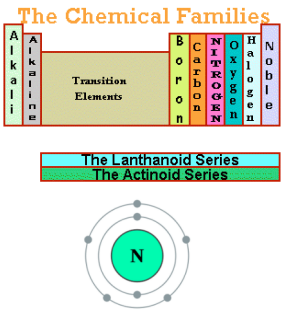
#14 or 4A: Carbon Family

- 4 valence electrons
- 1 metal, 1 metalloid, and 2 nonmetals.
- This family is incredibly important in the field of **technology**.
- C, Si, Ge, Sn, Pb



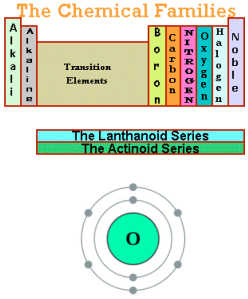
#15 or 5A: Nitrogen Family

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



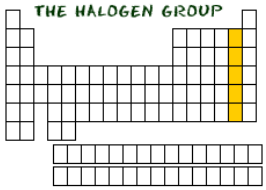
#16 or 6A: Oxygen Family

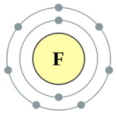
- 6 valence electrons
- O, S, Se, Te, Po
- 3 nonmetals, 1 metalloid, 1 metal
- reactive
- Most members form covalent (sharing bonds) compounds
- Must **share 2** electrons with other elements to form compounds.



Family #17 or 7B: Halogens

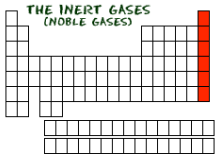
- **7** valence electrons
- F, Cl, Br, I, At
- **very** reactive
- They are very reactive because have 7 valence electrons, this means they are ALMOST full and can combine with many elements.
- **Nonmetals**
- Halogen elements combine with metals to form compounds called **salts**.





Family #18 or 8A: Noble Gases

- **8** valence electrons (except He which only has 2)
- "Happy" because their outer electron shell is filled!
- NON REACTIVE (inert) gases
- Nonmetals
- NO bonding with other elements
- He, Ne, Ar, Kr, Xe

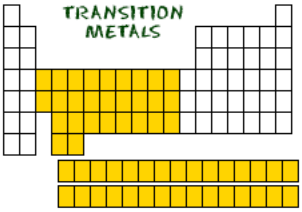


Hydrogen: stands alone

- **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**

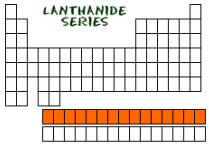
Family #3-12 (1B-8B): Transition Metals

- **1-2** valence electrons
- **Less** reactive than alkaline earth metals because they don't give away their electrons as easily
- Bottom 2 row are the Lanthanide & Actinide series

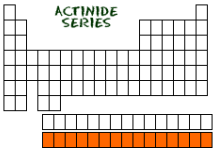


Family #3-12 (1B-8B): Transition Metals

- **Lanthanide** Series:
  - **shiny reactive metals**
  - **Most found in nature**



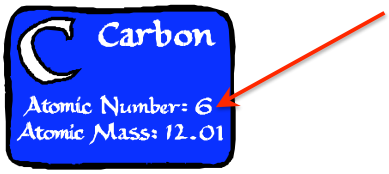
- **Actinides** Series:
  - **radioactive and unstable**
  - **Most are man-made & not stable in nature**



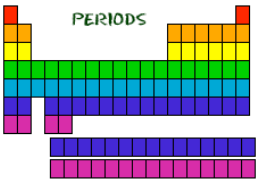
How to Draw
Bohr Model Diagrams
You will need to know this for the final exam

Bohr Diagrams

1) Find your element on the periodic table.
2) Determine the number of electrons – it is the same as the atomic number.
3) This is how many electrons you will draw.



Bohr Diagrams



- Find out which period (row) your element is in.
- Elements in the **1st A period** have **one** energy level.
- Elements in the **2nd A period** have **two** energy levels, and so on.

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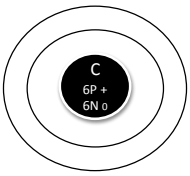
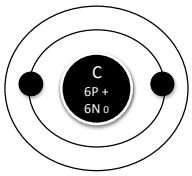
Bohr Diagrams



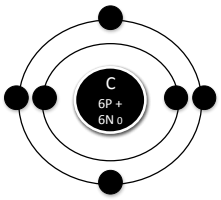
1) Draw a nucleus with the element symbol, proton number & neutron total inside.Remember how to calculate the number of neutrons.
2) Carbon is in the 2nd period, so it has two energy levels, or shells.
3) Draw the shells around the nucleus.

Bohr Diagrams



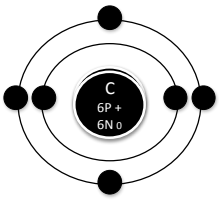
1) Add the electrons.
2) Carbon has 6 electrons.
3) The first shell can only hold 2 electrons.

Bohr Diagrams



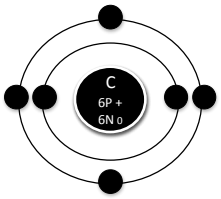
1) Since you have 2 electrons already drawn, you need to add 4 more.
2) These go in the 2nd shell.These are the **VALENCE Electrons.**
3) Add one at a time - starting on the right side and going counter clock-wise.

Bohr Diagrams



1) Check your work.
2) You should have 6 total electrons for Carbon.
3) Only two electrons can fit in the 1st shell.
4) The 2nd shell can hold up to 8 electrons.
5) The 3rd shell can hold 18, but the elements in the first few periods only use 8 electrons.

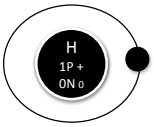
Bohr Diagrams: You Try It!



Try the following elements on your own:

a) H
b) He
c) O
d) Al
e) Ne
f) K

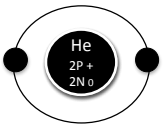
Bohr Diagrams



Try the following elements on your own:

a) H – **1 electron**
b) He
c) O
d) Al
e) Ne
f) K

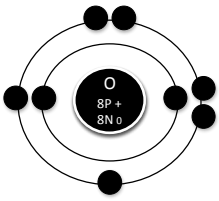
Bohr Diagrams



Try the following elements on your own:

a) H
b) He **- 2 electrons**
c) O
d) Al
e) Ne
f) K

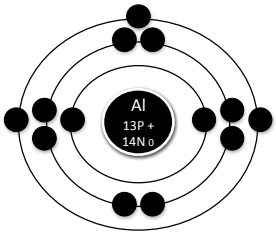
Bohr Diagrams



Try the following elements on your own:

a) H
b) He
c) O **- 8 electrons**
d) Al
e) Ne
f) K

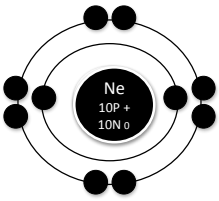
Bohr Diagrams



Try the following elements on your own:

a) H
b) He
c) O
d) Al **- 13 electrons**
e) Ne
f) K

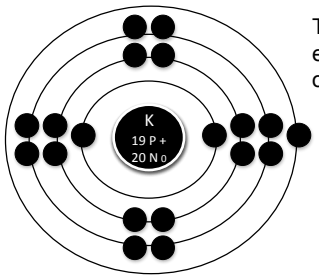
Bohr Diagrams



Try the following elements on your own:

a) H
b) He
c) O
d) Al
e) Ne **- 10 electrons**
f) K

Bohr Diagrams



Try the following elements on your own:

a) H
b) He
c) O
d) Al
e) Ne
f) K **- 19 electrons**

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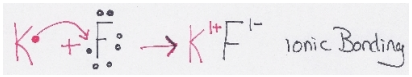

Show the arrows for ionic bonding & the ion charges
Show the bonding circles for covalent bonding