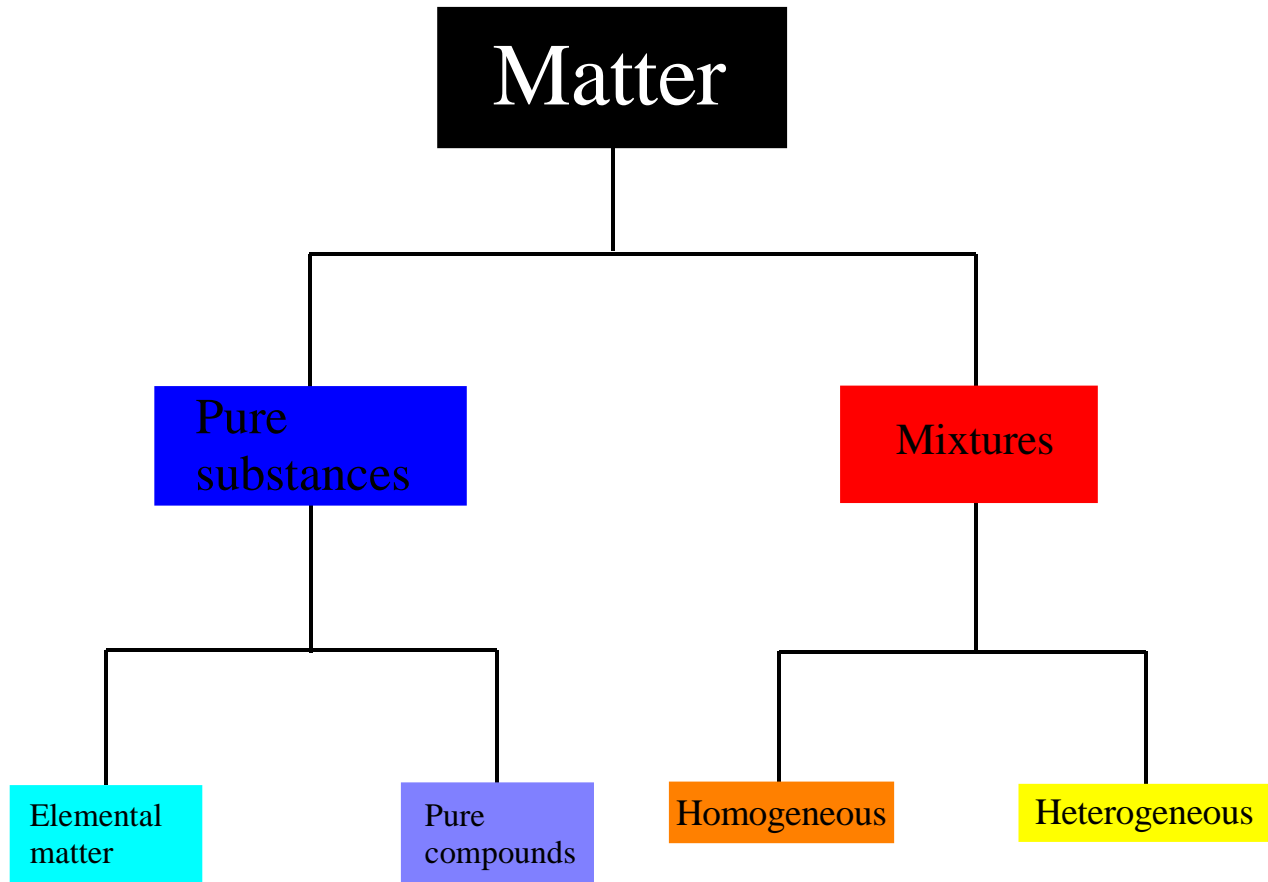


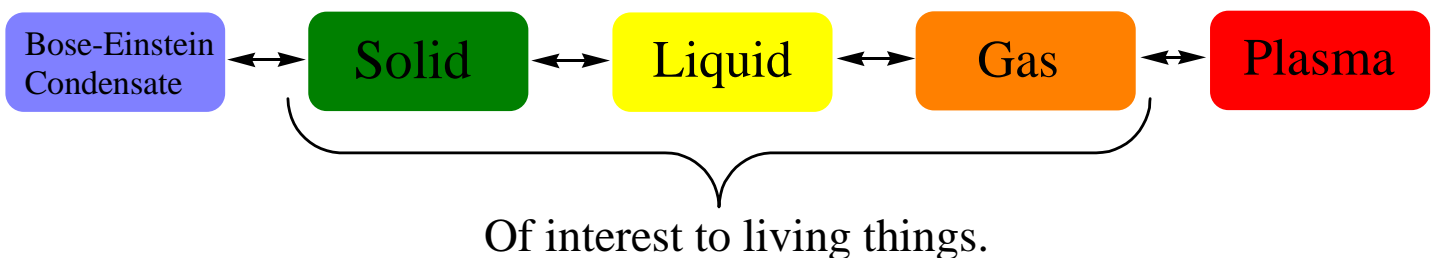
Compounds (vs. elements?)

I. Matter comes in different forms

A. Based on purity (examples of each?)



B. Based on temperature (Which side (*l* or *r*) is high temperature?)



III. The term *element* has two meanings in this context:

- A. At the macroscopic level, a substance composed of only one type of atom is “in its elemental state.” One type of atom means all of the atoms have the same number of _____.
1. Hydrogen, as hydrogen gas ($\text{H}_{2(g)}$), is in its elemental state.
 2. Platinum, as pure the metal ($\text{Pt}_{(s)}$), is in its elemental state.

Note: With respect to elemental identity, an atom with $6 p^+$ and $6 n$ in its nucleus is considered to be the same type of atom as one with $6 p^+$ and $8 n$ in its nucleus. These two different nuclei are said to both be _____ of carbon.

- B. At the atomic level, the *identity of an atom* (the *specific element* that it is) is determined by _____.

III. Most matter on earth & in your body isn't in its elemental form.

- A. If we consider the lecture room (or lab?), can you identify any matter that is in its pure elemental form? _____
- B. What about outside of the lecture room? _____



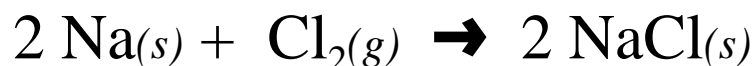
1. the blue stuff is...
elemental vs. compound
pure vs. mixture
homogeneous vs. heterogeneous
2. the white stuff...
3. the green stuff...

figure from: www.all-creatures.org/hope/index.htm

C. Do the answers to 1 - 3 above depend on how big of a block of blue (white, green) stuff we chose to examine?

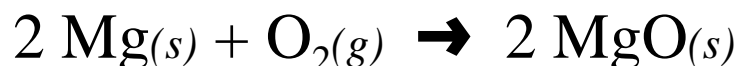
IV. *For conceptual purposes* I like to use pure elements as a reference point. I imagine them combining to form pure compounds. Examples:

A. Elemental sodium ($\text{Na}_{(s)}$) reacting with chlorine ($\text{Cl}_{2(g)}$) to form table salt ($\text{NaCl}_{(s)}$):



Not safe to do, but see: <http://www.youtube.com/watch?v=Mx5JJWI2aaw> & <http://www.youtube.com/watch?v=Ftw7a5ccubs>

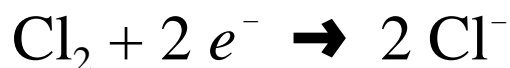
B. Elemental magnesium ($\text{Mg}_{(s)}$) reacting with oxygen ($\text{O}_{2(g)}$) to form magnesium oxide ($\text{MgO}_{(s)}$):



See: <http://www.youtube.com/watch?v=qVfAoRYmOpc>

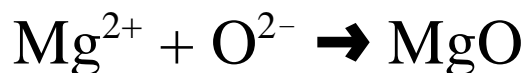
C. **Important:** Two distinct things occur in the rxns shown above, and I want you to be able to recognize them as distinct.

1. First, e^- are being transferred to convert atoms (or molecules) ions:



Metals tend to give e^- , non-metals tend to take them. *Electronegativity*
Comment re. oxidation/reduction rxns.

2. Second, positively charged ions bind to negatively charged ions to form ionic compounds:



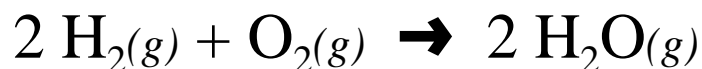
positively charged ions are called _____

negatively charged ions are called _____

In the reactions shown above, a ***metal combined with a non-metal to form an ionic compound***. The product is also called a ***salt***. The ions in the salt are held together by ***electrostatic attraction***, + to -.

What happens when we combine two non-metals?

D. Hydrogen gas ($\text{H}_2(g)$) reacting with oxygen ($\text{O}_2(g)$) to form water ($\text{H}_2\text{O}(g)$):



1. *The Hindenberg* was a less dense than air ship (specifically, a dirigible) whose buoyancy was provided by $\text{H}_2(g)$. A known risk associated with this technology was hydrogen reacting violently with oxygen. Is there a readily available source of the reactant O_2 on earth?

Viewer warning, people died <http://www.youtube.com/watch?v=F54rqDh2mWA>

2. In the rxn. shown above in, ***two non-metals combine to form a covalent compound***. The product is a ***molecule***. The atoms in the molecule are held together by covalent bonds.

V. Ionic bonds, ionic compounds, ionic compound formulas

A. In an ion: **# of p^+ \neq # of e^-** .

B. Ions can be simple or compound

1. A simple ion has one nucleus (Cl^-).

2. A compound ion has multiple nuclei held together by covalent bonds: NO_3^-

C. Ionic bond refers to the electrostatic attraction between oppositely charged ions.
What do like charged things do?

My son's static electricity hair experience: *a blonde Afro = a dandelion?*

D. Ionic compound formulas, must have zero net charge. Think lightning or static shock:

1. Determine charge on ionic components (Periodic Table)

2. Indicate the ***minimum whole number*** of each ionic component that results in ***equal amounts of + and - charge***.

(Do you remember how to determine the charge on stable ions of representative elements?)

Question Write ionic compound formulas for:

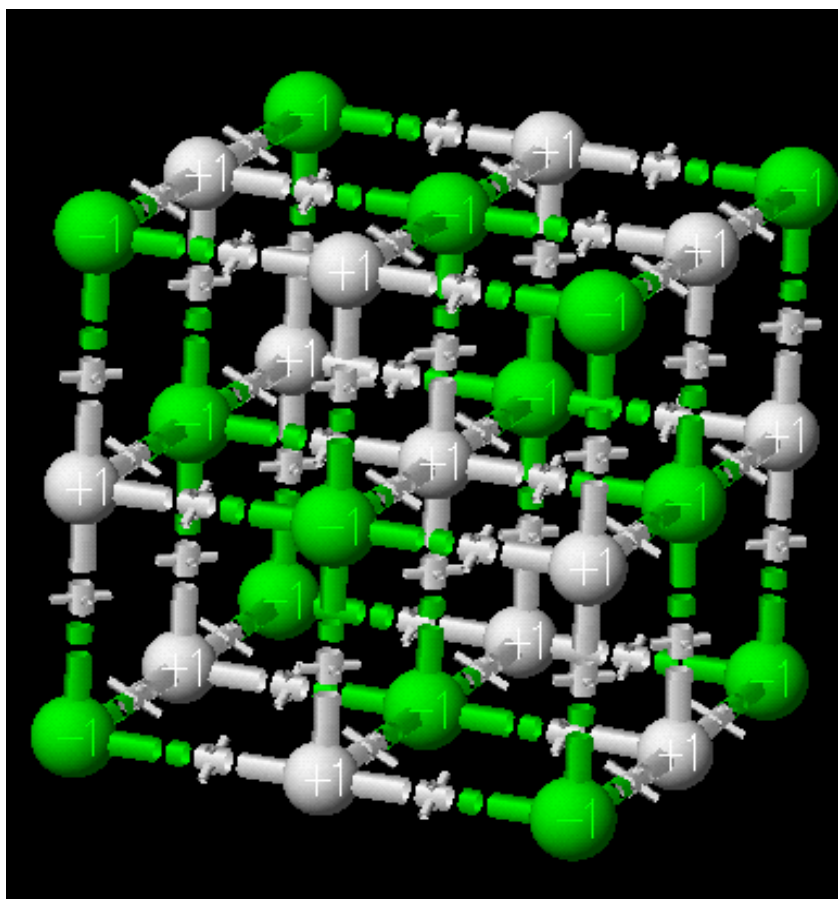
1. potassium chloride

2. sodium phosphate

3. iron (II) nitrate

Note: Although the ionic compound formula NaCl shows a 1 to 1 ratio of the ions, it is incorrect to think of a specific, directionally oriented interaction between one Na⁺ and one Cl⁻. You can see from the figure that each Na⁺ is actually interacting equally with 6 Cl⁻ ions (and *vice versa*).

Comment re. internal vs. surface ions? Most NaCl crystals contain *many, many* more ions than that shown below!



Ions also attract & repel each other in aqueous solution but the H₂O reduces the interaction strength significantly.

In CHM 109 we will have some interest in ions and ionic bonds, but we will have much more interest in covalent bonds. What is a covalent bond?

A covalent bond is a shared e⁻ pair.