Facts do not cease to exist
because they are ignored.
--Aldous Huxley

What are compounds like?

An *element* may be described as a substance in which all of the atoms are alike. Elements are the "stuff" of chemistry, but not quite the only stuff. If that were true, chemistry would be a lot simpler since there are currently known only 113 elements.

Elements are interesting in their own right and you will have the opportunity to learn a lot about them this year. But when elements combine in a special way that we describe as chemical, then they can form *compounds*. A compound is thus a substance in which not all of the atoms are alike.

To be more precise: in a compound elements are combined in some fixed ratio (by mass) and in such a manner that they cannot be separated by physical means (e.g., using a microscope and tweezers...), but will only yield to more chemical action if we want to separate them again.

Compounds are responsible for most of the material and biological diversity that surrounds us. Some compounds are good news (aspirin comes to mind). Others we could better do without (sulfur dioxide and nitrogen dioxide which contribute to acid rain, for example). So the study of compounds is really pretty important in chemistry. And therefore the question which is the title of this activity: **what are compounds like?**

It would be more interesting for you to answer that question yourself. But before you begin, here are a few things to keep in mind:

1. The properties of compounds are often not similar to the elements that compose them
   e.g., sodium metal reacts violently with water and chlorine is a poisonous gas, but sodium chloride is--to most people--relatively harmless
2. There are two very large categories of compounds which are based on properties that you can observe
3. There are a lot of compounds and it is impossible to fit every one into neat generalizations

Preparing to experiment

You will be provided with the following materials:

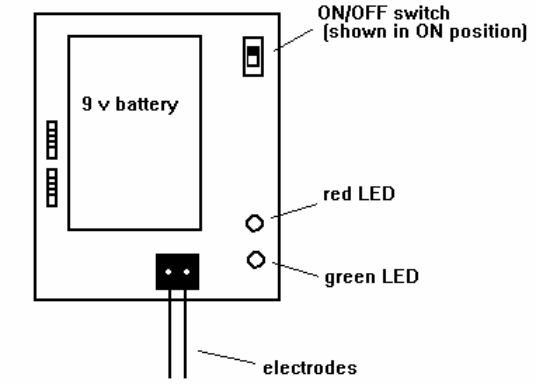
1. six compounds
2. conductivity device
3. 24-well plate
4. plastic stirrer

Design an experiment that will help you classify compounds as either *ionic* or *molecular* by testing whether the compounds are soluble in water and if their solutions conduct electricity. [see **Technique**]

Technique

1. The 24-well plates are convenient for making a battery of tests on SMALL amounts of compounds. You cannot judge solubility properly if you fill up the well with solid!!! This seems so obvious and yet….. Using your scoop, take a little of each solid (the size of a match head) and place it in one of the wells in the plastic plate provided. Fill the well up about half-way with distilled water from your wash bottle. Jiggle the plate a little. You can use a plastic stirrer if needed. DO NOT use your glass stirring rod as it will scratch the bottom of the well.

2. The little conductivity device you have is powered by a 9 volt battery and it measures the conductivity of a substance by passing electricity through the material. The relative amount of electric current that gets through is indicated by the LEDs (small colored lights).



All you need to do is pick up the device and place the two metal electrodes sticking out from one end into the solutions you prepared earlier in the wells. You should rinse the wires off between solutions with a squirt of distilled water. Record your conductivities in relative terms (no light = no conductivity, red = fair , red and green = good). You should also test tap water and distilled water just to have some kind of comparison.

If you have a compound which is not to be opened, it will have two wires inserted in the stopper. Touch the electrodes to these to check the conductivity.

Analysis

Questions 1-3 could easily be answered in a table. Feel free to use one if you like.

1. One way to divide compounds into categories is helpful for naming them. Compounds containing only two different elements are called *binary*. Carbon dioxide (CO_2) is a familiar example. Compounds containing more than two different elements are known as *ternary*. Sodium hypochlorite (NaClO), which is in bleach, is one such compound. Divide your compounds into these categories.

2. Look in your text book (inside front cover) and determine which of your compounds contained metals (or the ammonium ion*, NH_4^+) with non-metals and which contained non-metals only (*excluding* the ammonium ion). (for the purposes of naming compounds, metalloids are considered non-metals)

*the ammonium ion is a troublesome exception--look out for it

3. To name your compounds, you need to know a few rules. These are covered in your text in detail, so here are just a few basic reminders:

1. metals always come *first* in mixed compounds
2. all **binary** compounds end in -ide
3. **ternary** compounds have various endings
   MORAL: look them up until you learn them (p. 44—or Study Guide)
4. Greek numerical prefixes (p. 46) are only used
   with binary non-metal compounds (very few)

Name your compounds (in most cases you can name that compound in 2 words...). Some of your compounds may have already had names on them. Obviously you don't need to name them again! These are ternary compounds composed of only non-metals and are typically carbon compounds of some sort. Their nomenclature is beyond the scope of this course.

4. You now have your compounds separated into groups based on the kinds and numbers of elements they contain. Go back to your observations and try to come up with generalizations about each category of compounds. For example, are binary metal/non-metal compounds generally soluble in water? Do their solutions conduct electricity well? You get the idea.

5. There are, in fact, two major groups of chemical compounds, as you will discover in your reading. One group is *ionic*, the other is *molecular*. Ionic compounds consist of ions (charged atoms) which often separate in water and allow electricity to flow through the solutions. These ions (and others) are on the list of cations and anions you are learning. Molecular compounds consist of neutral molecules. Summarize the general behavior and constituents of ionic and molecular compounds based on your observations.

6. During the experiment you checked the conductivity of both distilled water and tap water. Based on your observations and the behavior of ionic compounds when dissolved in distilled water, what is a possible explanation for the difference in conductivity of tap and distilled water?