Module 4; Making and Naming Ionic Compounds Introduction

Elements/Compounds
Matter is anything that has mass and occupies space. Types of matter can be organized into several different categories. Pure substances are those that cannot be physically separated into different substances. Compounds are substances that can be separated into simpler substances only through chemical reactions. Salts, proteins, sugar, and dyes are all examples of compounds. Elements are the simplest form of matter that can be obtained through chemical reaction. The elements are all shown on the periodic table and include copper, gold, oxygen, and sulfur.

Reactions
Chemical reactions are processes in which one set of chemicals combine to form another set of chemicals. The initial set of chemicals are called reactants and the final set of chemicals are called products. Sometimes, it is not obvious that a chemical reaction has taken place. More often, however, there is a change in color, texture, shape, temperature, or other property to indicate that a reaction has occurred.

Reactions with copper to make ionic compounds
In the first three reactions you will observe the synthesis of ionic compounds from copper and one other element. Pennies will be the source of copper.

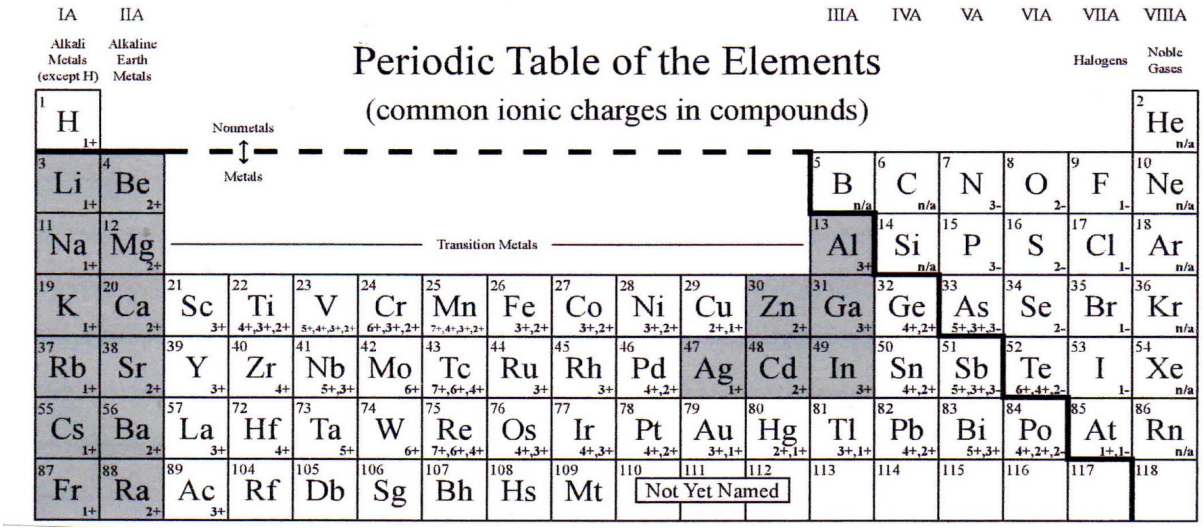
Reactions with oxygen to make ionic compounds
In the last three reactions, you will observe the synthesis of oxides (compounds with oxygen). Oxygen in the air will be the source of oxygen. Oxygen in the air is diatomic, O_2. Sometimes reactions need a "push" to get started. Usually, this push comes in the form of heat, which gives the reactants a burst of energy to start the reaction. The reactions forming oxides will need heat, which will be provided by a Bunsen burner flame to get the reaction started. The flame is NOT a reactant – it is energy used to get the reaction started.

Nomenclature
When the compounds are made in the demonstrations, you will also write the formulas and names for them. When naming compounds, first determine if the compound is ionic or covalent. Covalent compounds do not have a metal in them. Prefixes are used to name covalent compounds (carbon dioxide for CO_2 and Dinitrogen pentoxide for N_2O_5). If the compound is ionic, determine if the metal is a fixed metal or a variable metal. If it's a fixed metal, name the compound without any prefixes or Roman numerals (sodium chloride for NaCl, potassium nitride for K_3N). If the metal is a variable metal, find the charge on that metal and use a Roman numeral to show the charge (Nickel (III) chloride for $NiCl_3$, Nickel (II) oxide for NiO).

Note: In this lab, you will be observing four demonstrations from YouTube and doing one "kitchen" experiment. You will need the following materials for your experiment: Ziploc bag, penny, bleach, vinegar.

Pre-Lab Exercise.

Use the periodic table to answer the pre-lab questions below.



Note- In the above Periodic table, the shaded Metals are Fixed Charge Metals and rest other Metals are Variable charge.

Na_3N N_2O_4 CoF_3 CF_4 Pb_3N_2 KI S_4N_2

1) Provide the NAME (not the formula) as discussed in lecture/Notes on Naming compounds of all the compounds given above that are covalent:

2) Provide the NAME (not the formula) of all the ionic compounds with fixed metals. Identify the charge on each of those fixed metals (don't forget that a charge has both a sign and number such as +1 or -3).

3) Provide the NAME (not the formula) of all the ionic compounds with a variable metal. Identify the charge on each of those variable metals (don't forget that a charge has both a sign and number such as +1 or -3).

Data and Data Analysis

In the following reactions, you will observe the combination of metals with nonmetals to make compounds: What kind of compounds will they be (ionic or covalent)?_____

The names of some of some of the ionic compounds will NOT have Roman Numerals in them. Why not?
_____

The names of some of the ionic compounds you make will have Roman Numerals in them.
Why? _____

To determine the Roman Numeral, you need to know the _____ on the _____ in the compound.

NOTE: **Here's how you determine the charge of copper in an ionic compound based on appearance:**
Colorless copper compounds (including white) have copper (I) ions.
Colored copper compounds (red, black, green, blue) have copper (II) ions.
Exception: the red copper-oxygen product has a copper (I) ion.

COPPER AND CHLORINE

PROCEDURES	OBSERVATIONS	INFERENCES
Watch the following demonstration and answer the questions in columns 2 and 3. You will see the demonstration follow this procedure: 1) Bleach is in the bottle at the beginning of the reaction. 2) Sulfuric acid is dripped into the bottle. 3) Chlorine gas (Cl_2) is produced and trapped in the bottle. 4) A copper sheet is heated. 5) The hot copper sheet is then placed in the bottle with the chlorine gas. https://www.youtube.com/watch?v=edLpxdERQZc	What color are the reactants: Bleach: _____ Sulfuric Acid: _____ Copper sheet: _____ At first chlorine gas is produced. What color is the chlorine gas?_____ When chlorine gas is produced, is that a physical or chemical change? _____ Then the copper and chlorine react. What color is that product? _____	The new color is due to the product created when copper (from copper sheet) and chlorine (from bleach) form an ionic compound that drips back into the bottle. What is the charge on the copper in your new ionic compound? (see highlighted note above) _____ Name the ionic compound formed: _____ Write the formula for the ionic compound you formed:

COPPER AND SULFUR

PROCEDURES	OBSERVATIONS	INFERENCES
Watch the following demonstration and answer the questions in columns 2 and 3. You will see the demonstration follow this procedure: 1) Sulfur is put into a (dirty) test tube. What color is sulfur? _____ 2) A piece of copper wire is held in the test tube. What color is copper wire? _____ 3) The test tube is heated with a Bunsen burner. Observe the copper wire during the reaction. 4) The product is removed. https://www.youtube.com/watch?v=Jhu-0ACrMsQ	What color is the product? _____ How is the product different than copper wire other than being a different color? Is this a physical or a chemical change? _____	The new color is an ionic compound that is formed when copper (from the wire) reacted with sulfur. What is the charge on the copper ion in your new ionic compound? (see highlighted note above) _____ Name the ionic compound you formed: _____ Write the formula for the ionic compound you formed: _____

COPPER AND OXYGEN

PROCEDURES	OBSERVATIONS	INFERENCES
Watch the following demonstration and answer the questions in columns 2 and 3. In this demonstration, a copper sheet is folded into an envelope. (The purpose of this is that the "inside" copper will get less oxygen than the "outside" copper.) It is held over a flame and heated. https://www.youtube.com/watch?v=1qZxJG8xMmQ	What color flame did you see? (Flame is energy, not matter, released by excited ions): _____ The copper turns two different colors. What color is the inside of the copper sheet which got less oxygen? _____ What color is the inside of the copper sheet which got more oxygen? _____	Provide the formula and name for both products. (Remember the exception in the highlighted note above.)

IRON AND OXYGEN (steel wool and air)		
PROCEDURES	OBSERVATIONS	INFERENCES
Watch the following demonstration and answer the questions in columns 2 and 3. In the demonstration (with no sound), iron (steel wool) is heated and then dropped into a flask with oxygen in it. https://www.youtube.com/watch?v=TkE1uVjrY0w	The iron (steel wool) reacted with oxygen to make rust, Fe_2O_3. What color was the iron (Fe) you started with? _____ What color was the product? _____ Is the process of "rusting" a physical or chemical change? _____	Fe by itself (the steel wool), has no charge. What is the charge on the Fe in the rust, Fe_2O_3 ? _____ Provide the name of Fe_2O_3.
HOME EXPERIMENT		
PROCEDURES	OBSERVATIONS	INFERENCES
You will need: bleach, Ziploc bag, vinegar, penny. Place a penny in the corner of a plastic bag. Add ½ tsp of household bleach to the corner of the bag with the penny. (CAUTION: bleach contains a highly reactive form of chlorine. Handle with care.) Next, add ¼ tsp of vinegar. Squeeze the excess air from the bag and seal it. Allow the liquid to stay in contact with the penny for several minutes. Observe the contents of the bag and record your observations. Important: Take a picture of your home experiment (contents of the bag before cleanup) and attach it to your lab work along with your college ID or your picture.	Record your observations from the experiment: CLEAN UP To clean up, dilute the liquids with water and wash down the drain. Throw away the bag and the penny.	What do you think happened in this experiment? Be specific using what you learned from the previous four reactions in this lab.