Formulas and Oxidation States Lab Lab #16

Pre-Lab Discussion:

A chemical formula is a combination of symbols and numbers that represents the atoms bonded in a substance. The symbols tell which elements are involved, and the numbers indicate the relative proportion of elements. The oxidation numbers can be used to predict the proportion of atoms contained in a specific compound.

It is important that all scientists use the same system for writing chemical formulas. The following rules should be used to ensure clear and consistent transmission of information.

1. The sum of the positive and negative oxidation states in a compound must be zero.
2. Positive ions are written first (with *very* few exceptions).
3. When more than one of the same ion is required, a numerical subscript indicating the number of ions follows the symbol (polyatomic ions must be enclosed in parentheses), e.g. $Al_2(SO_4)_3$.

To name an ionic substance given its formula:

1. Write names of monatomic cations first (again, with *very* few exceptions).
   For elements with only one oxidation state, write the name of the element, e.g. sodium.
   For elements with multiple oxidation states, write a roman numeral in parenthesis after the ion indicating the charge, e.g. iron(III) or copper(I).
   For polyatomic cations, simply write the name of the polyatomic cation from Table E.
2. Write the anion names last.
   For binary compounds (two elements), change the ending of the anion name to 'ide', e.g. Cl^{1-} is chloride.
   For polyatomic cations, simply write the name of the polyatomic anion from Table E.

Research Question:

How can correct formulas for compounds be predicted?

Materials:

ion model page scissors

Method:

1. Construct formulas for compounds by using cation and anion models of the directed substances. Start with the cation (positive) and add an anion (negative). If the charges balance, the formula is complete. If the positive charges outnumber the negative charges add anions until the charges balance. If it is not possible to balance the charges, add anions until the combination is negative, then add cations until balanced or the combination is positive. Continue alternating until a balanced charge is reached.
2. Record the balanced formula by illustrating the model on your data sheet.
3. Construct models for the following combinations:
   a) magnesium and chlorine
   b) aluminum and bromine
   c) sodium and oxygen
   d) iron(II) and sulfur
   e) aluminum and nitrate
   f) potassium and sulfate
   g) iron(III) and chlorine
   h) ammonium and sulfur
   i) aluminum and oxygen
   j) iron(III) and sulfate
   k) sodium and phosphate

Data Collection and Processing:

Record all data and observations on the Data Tables.

Conclusions and Evaluations:

1. Some compounds are described as 'binary compounds' and are composed of two different elements. What ending is given to the anion in a binary compound? Refer to your Data Table and list the formulas for any binary compounds you constructed.

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2. Some elements have more than one possible positive oxidation state. The names of formulas containing these elements require roman numerals to create unambiguous names. Write correct names for the following formulas: $FeCl_2$, $FeCl_3$, Cu_2O, CuO, $Cr_3(PO_4)_2$, $CrPO_4$.

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3. Most polyatomic anions end in 'ate' or 'ite.' Name two that have different endings.

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4. Hydrogen peroxide and water both contain the same two elements. Fill in the table below that compares these two substances.

Name	Formula	H:O Ratio	Properties	Uses

5. Use hydrogen peroxide and water as examples to explain the importance of writing correct formulas.

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Applications:

1. What did YOU (personally) learn?

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2. By whom and how can any idea, principle, or activity in this lab be used in the real world?

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Substances to combine	Illustration of the model	Chemical Formula	Stock System Name

Substances	Illustration	Formula	Name