

Chem E-1a
Friday Review Notes
Chapters 1 and 2

What are the Friday Reviews?

The Friday Reviews are problem-solving sessions, and are not intended as recaps of the lectures. The reviews will function in conjunction with the lectures: each review will focus on problem-solving techniques involving material that was presented in the previous lecture.

Problem-solving is a skill that needs to be developed through practice, and the Friday Reviews, along with your sections, are intended to reinforce the skills and techniques needed to solve problems you will encounter on the Problem Sets and Exams. Mastery of these skills can only be developed through consistent practice by working through problems such as those on the problem sets and in the *Practice Problems*. The majority of time you spend working for this class should be spent doing problems.

Remember: If you don't have a pencil in your hand, then you aren't studying chemistry!

Problem-solving skills we will develop this week:

- Using Scientific Notation in Calculations
- Using Dimensional Analysis for Unit Conversions
- Counting Protons, Neutrons, and Electrons in Atoms, Molecules, and Ions
- Nomenclature: Writing Correct Names and Chemical Formulas for Atoms, Molecules, and Ions

From the Lecture Notes:

Chem E-1a Nomenclature: What you need to know

Ionic Compounds:

Know the names, symbols, and charges of **all** ions (monatomic and polyatomic ions) that appear in Table 2.2 and Table 2.3 on pages 45-46 of the textbook. Note that the charges of many of the monatomic ions are easy to determine from their position on the periodic table (see Figure 2.10 on page 40 for an example of the trends.) For transition metal ions with multiple oxidation states (e.g. Fe^{2+} and Fe^{3+}) you should be familiar with both the newer system ("iron (II)" and "iron (III)") and the older names ("ferrous" and "ferric"). You should be able to write the names and chemical formulas of any ionic compound formed from any of these ions.

Molecular Compounds:

You should know the names and symbols of all of the nonmetals on the periodic table. (These are the elements shaded blue on the periodic table on page 38 of your textbook.) You should know the Greek prefixes listed in Table 2.4 on page 48 of your textbook, and you should know the rules for naming molecular compounds using these Greek prefixes. You should be able to name and write the chemical formulas for any binary molecular compound. You only need to know the "common" or "non-systematic" names of the molecular compounds water (H_2O) and ammonia (NH_3).

Elemental Diatomic Molecules:

You should know the 7 elemental diatomic molecules: H_2 , N_2 , O_2 , F_2 , Cl_2 , Br_2 , and I_2 . These are easiest to "memorize" by noting the position of each on the periodic table: there is hydrogen, and then the other 6 elements form an inverted "L" on the periodic table. Or, alternatively, you could remember the mnemonic "BrINCiHOF".

Acids:

You should know the names and formulas of the following acids. HF , HCl , HBr , HI , HNO_3 , H_2SO_4 , H_3PO_4 , and CH_3COOH (acetic acid).

Bases:

You should know the names and formulas of the following bases: NaOH , KOH , $\text{Ba}(\text{OH})_2$, and NH_3 (ammonia).

Hydrates:

You do not need to know how to name hydrates.

Organic Compounds:

You do not need to know how to name organic compounds.

Note: The periodic table you will be given on the exams is identical to the one posted on the course website and included in your *Practice Problems*.

The textbook gives thorough information on how to name and how to write the chemical formulas for all different types of substances: elements, ions, molecular compounds, and ionic compounds. But one thing that students often struggle with is determining what type of substance something is. The following “rules” provide a simple checklist that will assist you with naming compounds and writing chemical formulas by helping you classify the substances you see as elements, ions, molecular compounds, or ionic compounds. These steps will soon become second nature, and you won’t even think about them! But for now it may be helpful to consider these questions as you work on nomenclature.

Determining the name of a compound from the formula

If you need to determine the name of a substance when you are given the chemical formula, follow these steps in the order listed before attempting to assign a name.

1. Does the substance have a charge? Any charge would be indicated with a superscript immediately following the chemical formula.
 - If the substance is charged, then it is an ion. It will be one of the monatomic or polyatomic ions that you have learned. The name of the substance is simply the name of the ion.
 - If the substance is not charged, then it is either an element, a molecular compound, or an ionic compound. Continue to the next step.
2. Does the substance consist of one element or of multiple elements?
 - If the substance only contains one element, then it is just an element. The name of the substance is simply the name of the element. Be aware that this would also include the 7 diatomic elements.
 - If the substance contains multiple elements, then it is either a molecular compound or an ionic compound. Continue to the next step.
3. Does the substance contain any metal elements or the ammonium ion, NH_4^+ ?
 - If the substance contains a metal or it contains the ammonium ion, NH_4^+ , then it is an ionic compound. Follow the rules for naming ionic compounds.
 - If the substance contains only nonmetals (and does not contain the NH_4^+ ion) then it is a molecular compound. Follow the rules for naming molecular compounds. Also be aware of the two “common” names we learned—water (H_2O) and ammonia (NH_3). Note also that the compound could be an acid, either a binary acid like hydrochloric acid (HCl) or an oxoacid like nitric acid (HNO_3). The chemical formulas of acids are usually easy to spot because they usually contain one or more “H”s at the beginning of the formula. (But be careful—acetic acid, CH_3COOH , looks different!)

Determining the formula of a compound from the name

If you are given the name of a chemical substance and you need to write the chemical formula, follow these steps in the order listed before attempting to write the formula.

1. Does the name consist of one word or two words?

- If the name is only one word, then the substance is either an element (watch out for the 7 diatomic elements!), an ion (it could be a monatomic or polyatomic ion), or one of the common names we learned (either water, H_2O , or ammonia, NH_3). You should recognize the name from the lists of elements, ions, and common names that you have learned. Simply write the formula for the substance just as you have learned it.

- If the name consists of two words, then it is either a molecular compound or an ionic compound. Continue to the next step.

2. Does the name include the names of any metal elements or the ammonium ion?

- If the substance includes any metals or includes the ammonium ion, then it is an ionic compound. Write the formula for the ionic compound according to the rules you have learned for writing the chemical formulas of ionic compounds.

- If the name of the substance only includes nonmetal elements (and doesn't include the ammonium ion), then it is a molecular compound. These will usually be easy to spot because the name will also include at least one of the Greek prefixes that you have learned (mono-, di-, tri-, etc). Follow the rules for writing the formulas of molecular compounds. Be aware that the acids you have learned are also molecular compounds, but they will be easy to spot due to the word "acid" in their name.