

# Experiment 1

## Scientific Writing Tools

### OUTCOMES

After completing this experiment, the student should be able to:

- insert a variety of mathematical equations into a *Word* document.
- draw line structures of and name organic molecules.

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### DISCUSSION

In this laboratory activity, you will work with two different software applications that allow you to prepare more professional-looking scientific papers. The skills you learn in this laboratory should complement and enhance some of the data analysis and reporting skills you learned in the first semester of this General Chemistry. For review, go to the [Chem 1061 website](#) and select Lab 3 ([Spreadsheets I](#)) and Lab 4 ([Spreadsheets II](#)).

Both of the software applications being used in this activity may be accessed from and integrated into any Microsoft Word document. Rather than giving you complete instructions on how to use the two applications, which is close to impossible, your instructor will demonstrate many of the features during the lab. Just as it is with anything new, it will take you some time before you begin to feel comfortable with their use. Few of you probably sat down with an instruction manual to learn how to use a word processor, web browser, or spreadsheet. Rather, you gained knowledge through experience. The same will probably hold true in this instance.

The first application is **equation editing** which may be done with either Microsoft *Equation 3.0* or the built-in equation editor in *Word*. Some may have used these features in other classes as well since equation editors are applications that provide the ability to write many types of mathematical equations and symbols. They are especially useful for writing fractions, roots, and symbols with combined super- and subscripts.

*Equation 3.0* is integrated into all recent versions of Microsoft *Office* and Microsoft *Works*. While it may be run directly as an application, it is typically installed on computers as an "object" in *Word* or *PowerPoint*. In order to use *Equation 3.0*, you will need to first open Microsoft *Word* on your computer. Then under the "Insert" menu, select "Object." Under the object type, select "Microsoft *Equation 3.0*." You will see a number of templates for mathematical symbols and equations. The instructor will demonstrate a few of the templates before you begin your assignment.

Newer versions of Word typically have an equation editor integrated into the program. The integrated equation editor may be found by looking under the "Insert" tab and selecting "Equation" which is on the far right of the menu options. You will see a number of templates for mathematical symbols and equations. Again, the instructor will demonstrate a few of the templates before you begin your assignment.

The second application that will be explored in this lab is a **chemical drawing program** such as *ChemSketch*. The main purpose of this type of program is to create line structures for organic, and sometimes inorganic, molecules. In addition, because the program is specific to the discipline, you can draw other "shapes" used in chemistry such single-headed arrows or equilibrium arrows. These types of drawing programs allow a user to generate IUPAC names for the molecules created as well as optimize the geometry.

There is one main chemical drawing programs available for you to use in the lab. It is called *ChemSketch 10.0 Freeware*. In addition to the standard structures, names, and equations mentioned already, *ChemSketch* can also generate color-coded 3D structures that may be viewed and rotated in any direction. It is designed for use in both organic and inorganic chemistry. An alternative to *ChemSketch* that may be found on the computers is *Accelrys Draw 4.0* which is also used to draw molecules and write chemical equations and formulae, although it does not have 3D capabilities. *Accelrys Draw 4.0* is designed primarily for organic chemistry though it may also be used for inorganic chemistry.

Both *ChemSketch* and *Accelrys Draw* are installed on all of the laboratory computers in the upper science building and should be installed in the main open computer lab on the Coon Rapids campus. You are welcome to use the program at home as a student. The *ChemSketch* program may be downloaded at <http://www.acdlabs.com/download/chemsk.html>. *Please note that you are not allowed to install software on any campus computer.*

Once installed, you will be able to launch *ChemSketch* from the Start menu or the desktop. However, to integrate it into your Word document, you will need to first open Microsoft *Word*. Then under the "Insert" menu, select "Object." Under the object type, select the program which you are going to use. Alternatively, you may create objects directly in *ChemSketch* and copy and paste them into your *Word* document. In the *ChemSketch* program, you will see a number of templates for chemical structures and equations. The instructor will demonstrate a few of the templates before you begin your assignment.

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## PROCEDURE

Open a new document in Microsoft *Word*. Place your name(s), the course number, date, and professor's name in the upper left hand corner of the first page. At your instructor's discretion, you may be asked to complete this lab on an individual basis or in pairs. Save your document regularly to avoid accidental loss of data.

### Procedure 1: Equation Editing

Place the following items in your document using *Equation 3.0* objects or the *Word* integrated equation editor. The page numbers refer to the 3<sup>rd</sup> edition of the Tro *Principles of Chemistry* text.

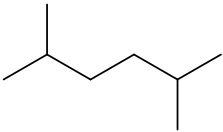
1. The equation that gives the definition of molarity in the center of p. 138.
2. The **2<sup>nd</sup> equation** under "Clausius-Clapeyron Equation (11.5)" in the middle of the back cover.
3. The **first** chemical equation showing the catalyst below the arrow on p. 548. The equation begins with "ClONO<sub>2</sub>."
4. The solution for the quadratic equation, given on p. 582 (step 5, right column, last equation containing a square root). The equation begins with "x = -(-0.76)."
5. The first equation beginning with "S = " in Example 16.8 on p. 676 (the one with the variable  $K_{sp}$ , not the numbers).
6. The nuclide symbol of a nucleus having 19 protons and 21 neutrons. See p. 55 if you need a reminder on how to write the nuclide symbol for an isotope.
7. The full set-up using **dimensional analysis** and the **solution** for problem 12, part c on p. 169.

### Procedure 2: Drawing Molecules

Place the following items in your document using *ChemSketch 10.0 Freeware* objects.

1. The equation under "For Practice 14.4" on p. 574, showing the double arrow. The equation begins with "4 HCl(g)."

2. The molecule, , with the IUPAC name generated by *ChemSketch*.

3. The molecule, , with the IUPAC name generated by *ChemSketch*.

- The hydrocarbon reactant in problem 48c on p. 993 of the Ch 20 packet, with the IUPAC name generated by *ChemSketch*. Please use the line structure of the molecule, not the condensed structural formula given in the problem.
- The molecule in 77a on p. 995 of the Ch 20 packet, with the IUPAC name generated by *ChemSketch*.
- The molecule in 81b on p. 996 of the Ch 20 packet, with the IUPAC name generated by *ChemSketch*.
- A molecule of  $\text{PBr}_3$ , drawn to the best of your ability, giving the appropriate name.

## POSTLAB ACTIVITY

You will be turning in the *Word* document that you created for this experiment. It will be completed either individually or in pairs, according to your instructor's directions. Follow your instructor's directions for submitting the document. If you are submitting electronically, please use the following convention for naming your document: *Lastname Firstname Writing Tools* for an individual document or *Lastname1 Lastname2 Writing Tools* for a group document. If you are emailing the document, use a subject line of *Chem 1061: Writing Tools Lab*.

### APPENDIX 1: Screenshot of *ChemSketch* template (Structure)

The screenshot shows the ChemSketch software interface with the following annotations:

- In the Structure menu**: Points to the 'Structure' menu in the top-left corner.
- Pick one object**: Points to the 'Lasso' tool in the toolbar.
- Select an atom and double click on structure to change identity of single atom or click before drawing bond and atom will be at both ends**: Points to the '3D Bonds' tool in the toolbar.
- Draw bonds (click on a bond in the drawing again to make multiple bonds)**: Points to the 'Eraser' tool in the toolbar.
- Tools drop down menu contains clean structure and generate name**: Points to the 'Arrow Options' dropdown menu.
- Options drop down menu contains preferences for changing how atoms appear in the structure**: Points to the 'Clean Structure' dropdown menu.
- Name from Structure**: Points to the 'InChI' button in the toolbar.
- Templates for larger objects**: Points to the 'Templates' panel on the right side of the interface.

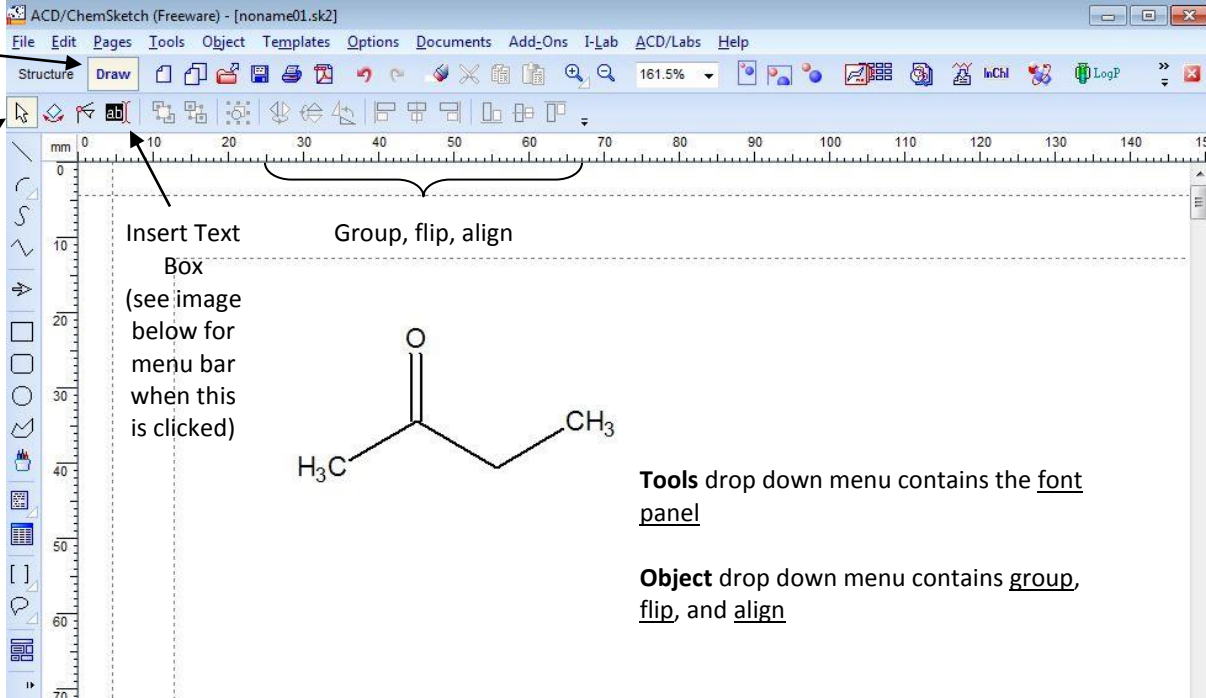
The central workspace displays a skeletal structure of 2-butanone (SMILES: CCC(=O)C).

## APPENDIX 2: Screenshots of ChemSketch templates (Draw)

In the **Draw** menu

Select arrow

Various shapes



mm 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

Insert Text Box  
(see image below for menu bar when this is clicked)

Group, flip, align

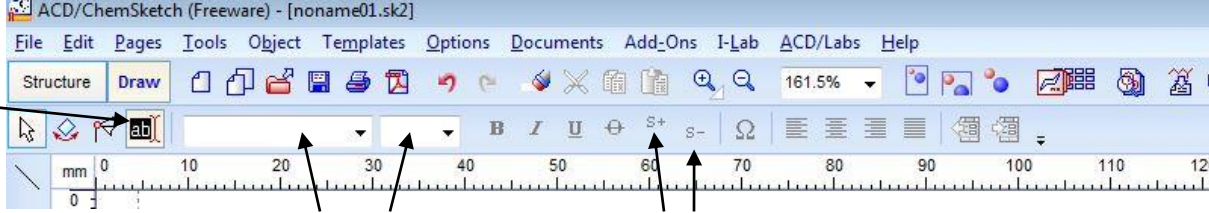
CC(=O)C

**Tools** drop down menu contains the font panel

**Object** drop down menu contains group, flip, and align

Detailed description: This screenshot shows the ChemSketch interface with the 'Draw' menu open. The menu bar includes File, Edit, Pages, Tools, Object, Templates, Options, Documents, Add-Ons, I-Lab, ACD/Labs, and Help. The 'Draw' menu is expanded, showing options like 'Insert Text Box' and 'Group, flip, align'. A chemical structure of acetone (CH<sub>3</sub>-C(=O)-CH<sub>3</sub>) is displayed in the center. A ruler at the top shows measurements in millimeters. On the left, a vertical toolbar contains various drawing tools. Annotations with arrows point to the 'Draw' menu, the 'Insert Text Box' option, and the 'Group, flip, align' option. Text boxes provide additional information: 'In the Draw menu' points to the menu bar, 'Select arrow' points to the mouse cursor, 'Various shapes' points to the toolbar, and two text boxes describe the contents of the 'Tools' and 'Object' drop-down menus.

In Text Box menu



Choose font and size

Super- and subscript

Detailed description: This screenshot shows the ChemSketch interface with the 'Draw' menu open, specifically the font panel. The menu bar includes File, Edit, Pages, Tools, Object, Templates, Options, Documents, Add-Ons, I-Lab, ACD/Labs, and Help. The 'Draw' menu is expanded, showing options like 'Insert Text Box' and 'Group, flip, align'. The font panel is visible, showing options for font face, size, bold, italic, underline, and superscript/subscript. Annotations with arrows point to the 'Draw' menu, the font panel, and the superscript/subscript options. Text boxes provide additional information: 'In Text Box menu' points to the menu bar, 'Choose font and size' points to the font face and size dropdowns, and 'Super- and subscript' points to the superscript and subscript icons.