Introduction to Excel and Computer Manipulation of Data

Review **Appendix A: Introduction to Statistical Analysis.** Focus on the meanings and implications of the calculated values and not on the calculations. You will learn how to do the calculations using Excel for your labwork.

Overview of Tutorial. Data analysis is an important part of any experimental effort. In this tutorial, you will learn how to use an Excel spreadsheet to record and analyze your experimental observations. Throughout Chem 142/152/162, you will need to know how to use the basic features of Excel to: perform calculations, create plots, adjust the formatting of your data and plots, determine by visual inspection if data is plotted linearly, and use the Linear Least Squares method to determine the best fit straight line of your data. Using a spreadsheet to analyze and plot your data can save you time, most likely reduce the number of errors that you make, and will allow you to easily make changes, since Excel can automatically update information for you. Additionally, this tutorial will teach you tricks and tips that will help you save time when you use Excel. Be sure that you fully understand how to perform all the tasks outlined in this tutorial.

This short tutorial consists of three parts, which will be divided into separate documents and posted on the Chem 142/152/162 lab websites. In the first part, provided below, you will create a basic spreadsheet and perform a few simple calculations with experimental data. In the second part, you will work with data related to create graphs. In the third part, you will determine if the data suggests a linear relationship and if so, you will generate a best fit line and determine the slope, y-intercept, error in the slope, error in the standard deviation, and correlation coefficient for the data. If the data does not suggest a linear relationship, you will determine a way to generate a plot that will give a linear relationship.

Each section begins with a general description and instructions of how to perform the required operations. At the end of the section, there are specific instructions for the exercises you should try to complete.

Part I. Introduction to Spreadsheets

What is a Spreadsheet? A spreadsheet is a software application that allows you to create and manage “sheets” of information. Typically, a spreadsheet is used to store and manipulate numeric data. The basic design of a spreadsheet follows the concept of a ledger sheet, or a grid of data. The grid is divided into columns and rows. The columns are labeled “A, B, C,…” and the rows are labeled “1, 2, 3, …”, by default. You can store text, numbers, formulas, graphs, and other data in the grids of each sheet, see Figure 1.

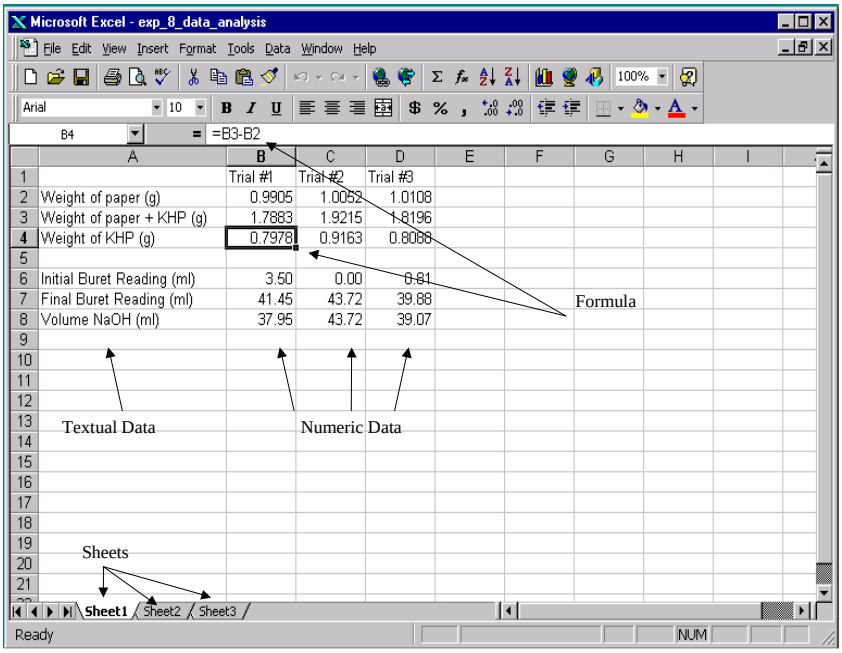
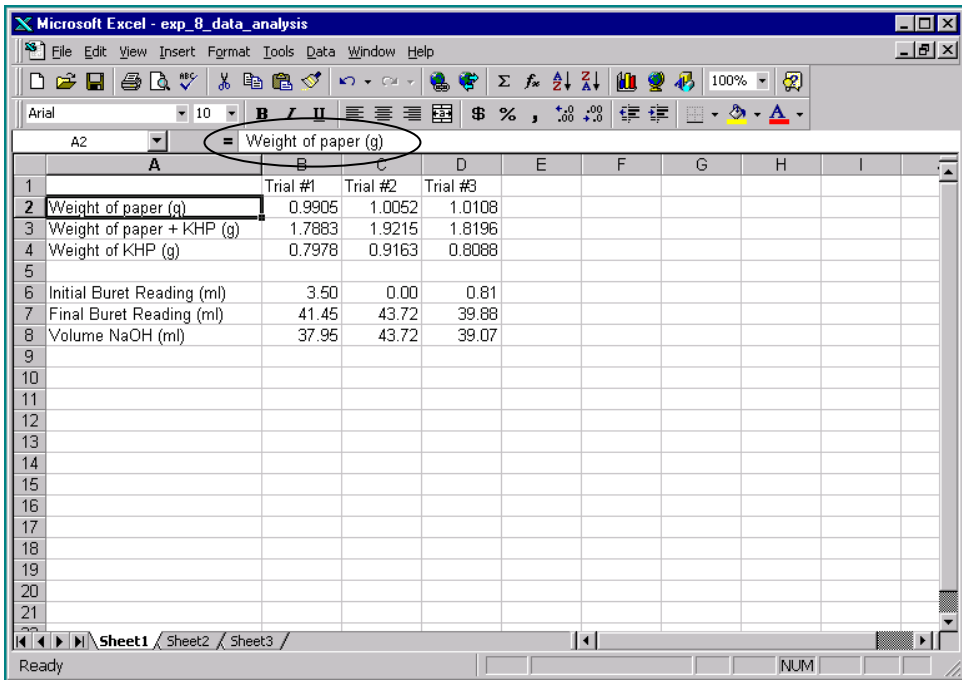


Figure 1: Basic Spreadsheet

Spreadsheet Basics. The Excel spreadsheet contains the following basic components: the main menu bar, icons, and worksheets. The main menu bar contains a hierarchy of menu choices that you can select to perform common operations. For example, the File menu contains a list of submenus of file-related operations, such as, Open, Close, Save, and Print. You should familiarize yourself with the main menu options and the submenus. Many of these menu items are also available by clicking on the appropriate icon. For example, the printer icon allows you to print your spreadsheet. Within each spreadsheet or file, also known as a workbook, you can create a number of worksheets, which are labeled “Sheet”. Worksheets allow you to organize your information into separate areas, while allowing you to refer to values on different worksheets.

Another useful and important basic function of Excel is the Help facility. Help can be obtained by selecting an option from the Help menu, by pressing the F1 key, or by clicking on the Office Assistant and entering a question.

Entering Data. Once you have opened or created a new spreadsheet, you can easily enter data into the rows and columns of the worksheet. Simply click on the row and column where you want to place the data and then type the data. Notice that the data you type appears in the row and column you have selected and also in the area next to the equal sign, see Figure 2.



	A	B	C	D
1		Trial #1	Trial #2	Trial #3
2	Weight of paper (g)	0.9905	1.0052	1.0108
3	Weight of paper + KHP (g)	1.7883	1.9215	1.8196
4	Weight of KHP (g)	0.7978	0.9163	0.8088
5				
6	Initial Buret Reading (ml)	3.50	0.00	0.81
7	Final Buret Reading (ml)	41.45	43.72	39.88
8	Volume NaOH (ml)	37.95	43.72	39.07

Figure 2: Entering data: The cursor is located at the A2 cell, as indicated by the bold outline around the cell. Also, notice that the cell contents are shown in the window next to the equals sign (circled area on the screen).

By default, columns are created with a width of 8.43 characters. If you want to enter data that exceeds 8.43 characters in width, you can change the cell width by clicking on the cell that you wish to change and then selecting Format→Column→Width, and entering the new width and then clicking on the OK button. Or, you can drag the boundary to the right side of the column heading until the column is the width you want. A column of numeric data that is too small to display the data will display "###". If this happens, simply adjust the column width and you will see your numbers.

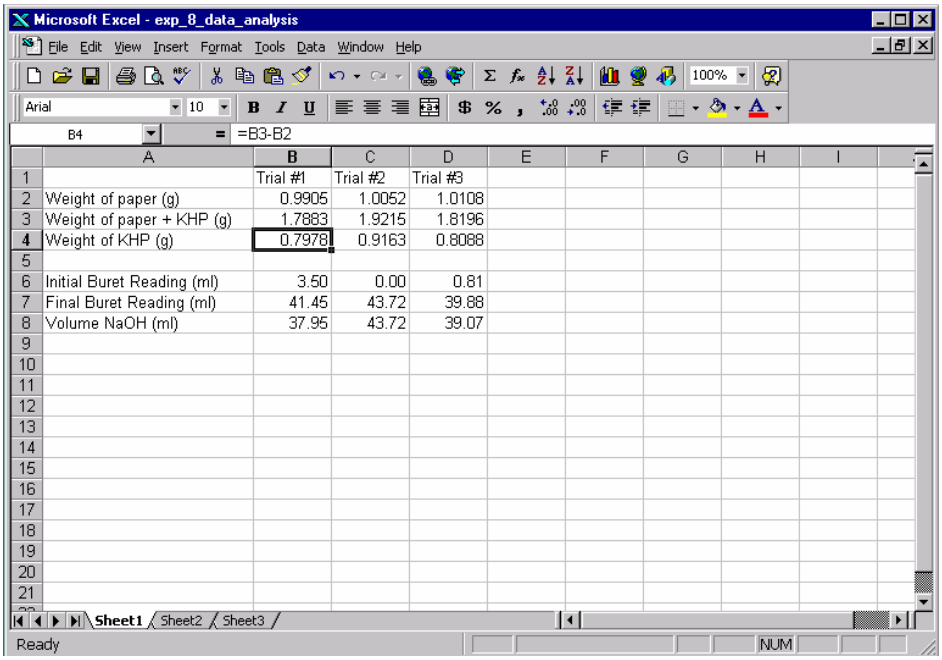
You can also change the default formatting of data in cell(s) by selecting Format→Cell from the main menu. The Format Cell dialog box allows you to change the formatting for Numbers, Alignment, Fonts, Borders, Patterns, and Protection. If you want to format a group of cells, highlight all the cells then select Format→Cell.

Entering Formulas. There are a number of ways to enter formulas into a worksheet. Below is a description of three ways to enter a formula into a cell.

Entering a Formula Directly Into a Cell:

1. Click on the cell that you want to contain the formula.

2. Type the equals sign "=" followed by your formula. For example, enter "=B3-B2" to subtract cell B2 from cell B3, see Figure 3.



	A	B	C	D
1		Trial #1	Trial #2	Trial #3
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Figure 3. Entering a Formula in a Cell

Entering a Formula from Equals Area:

1. Click on the cell that you want to contain the formula.
2. Click on the area next to the equals sign.
3. Type the equals sign.
4. Enter your formula.

Entering a Formula Using the Formula Wizard:

1. Click on the cell that you want to contain the formula.
2. Click on the Formula Wizard  Icon.
3. Select the Function Category in the left-hand column, see Figure 4.
4. Select the specific function in the right-hand column, see Figure 4.
5. Follow the Formula Wizard instructions.

   Note: You will find the formulas for calculating the average and standard deviation under the “Statistical” category and listed as “AVERAGE” and “STDEV”. These will be very common calculations in Excel for Chemistry lab reports.

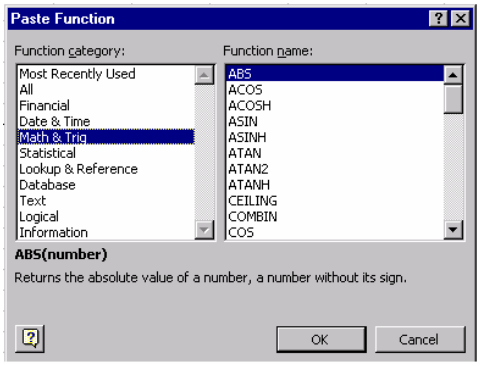


Figure 4. Formula Dialog box

Selecting, Copying, and Pasting Data. You may find it useful at times to select, copy, and paste data. There are several ways to accomplish this using Excel. As described earlier, you can select a single cell by clicking on that cell. To select several consecutive cells, click on the first cell and then drag the mouse to the last cell. To copy a cell or multiple cells, select the cell(s) you want to copy then either: select Edit→Copy or use the shortcut keys (Ctrl+C on the PC), or you can use the right mouse button menu. Note that the shortcut keys are displayed on the menu. To paste the cell, click on the cell where you want to paste the cell(s) then select Edit→Paste or use the shortcut keys (Ctrl+V on the PC), or you can use the right mouse button menu. The cell that you select, copy, or paste, can contain, numbers, text, or formulas. Another way to duplicate cells with data or formulas is to click on the cell and then click and drag the lower right-hand corner of the cell up, down, or across. This will automatically copy the data in the cell. Notice that when you click on the lower right-hand corner of the cell, the cursor will change to a large plus sign. Also, notice that the formulas are, by default, automatically adjusted based on where you have moved them. For example, when you copy the formula in cell B4 to C4 the formula becomes C3-C2. If you want more information about referencing cells, go to the help index and look at “references (cell)→absolute/relative/mixed”.

Saving and Printing Worksheets. Be sure to save your worksheet often, so that you do not inadvertently lose any of your data. Save your worksheet by selecting File→Save and entering a file name or by clicking on the Save icon. You can print your worksheet by selecting File→Print or by clicking on the Print icon. Before you print your worksheet, you may want to adjust your page setup by selecting File→Page Setup. From the setup dialog box, you can adjust page settings such as the page orientation (landscape or portrait), margins (top, bottom, left, right), headers and footers, and sheet settings. For example, you can create a custom header to contain the name of your experiment or you can create a custom footer to contain your name, the page number, and the date the worksheet is printed.

Part I: Exercise

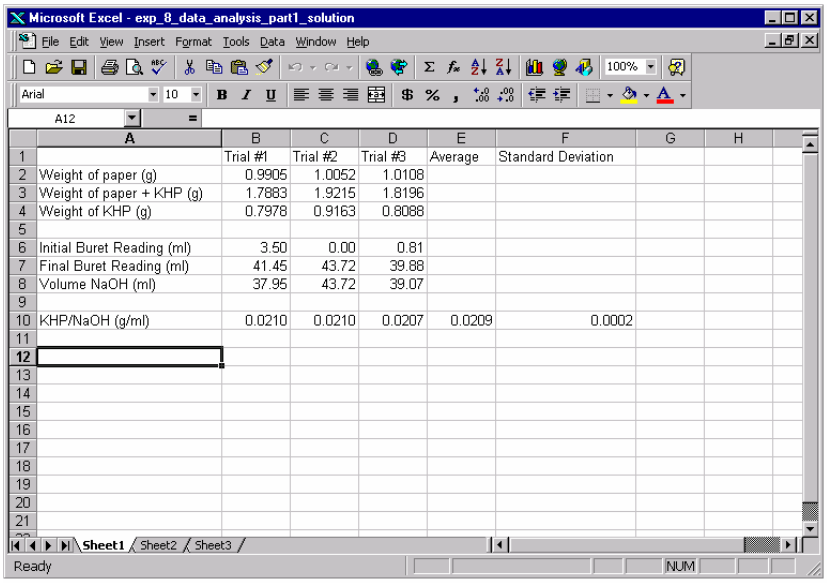
This exercise will give you an opportunity to become familiar with the basic features of Excel. You will create the spreadsheet shown in the previous figures and you will add some additional calculations to the worksheet.

Procedure

1. Open Excel by double clicking on the Excel icon on the computer desktop or by selecting it from your program menu.
2. Type the headings starting in cell A2. Notice that the cell is not large enough for all the data.
3. Format column A so that it is large enough for the data.
4. Enter the column headings for B1, C1, and D1.
5. Enter the data in cells A2, A3, B2, B3, C2, C3.
6. Enter the formula for B4.
7. Copy the formula from B4 to C4, and D4.
8. Enter the remaining data and formulas.
9. Add a row that shows the grams of KHP per ml of NaOH for each of the trial runs.
10. Add a column to show the average g/ml of KHP/NaOH.
11. Add a column to show the standard deviation in the average.
12. Format your numeric data to show the appropriate number of decimal places.
13. Add a custom header that includes the title of this experiment and your laboratory section.
14. Add a custom footer that includes your name, the page number, and the date.

Your completed spreadsheet should look like the spreadsheet shown in Figure 4.

Figure 4. Completed spreadsheet for Part I.



	A	B	C	D	E	F	G	H
1		Trial #1	Trial #2	Trial #3	Average	Standard Deviation		
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8	Volume NaOH (ml)	37.95	43.72	39.07				
9								
10	KHP/NaOH (g/ml)	0.0210	0.0210	0.0207	0.0209	0.0002		
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Please see the TAs in the Chemistry Study Center (BAG 330) if you need additional help with using Excel.

Part II: Creating Graphs

Part III: Linear Regression Analysis