Experiment 3
Microsoft Excel in Scientific Applications I

OUTCOMES

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

- demonstrate basic computer survival skills (opening, closing, printing and saving files; copying, cutting and pasting text and/or cells; formatting text and/or cells).
- enter formulas and perform calculations using *Microsoft Excel*.
- perform statistical analyses of data using *Microsoft Excel*.
- prepare and display different types of graphs of data.

DISCUSSION

Computers and computer-based instrumentation are used every day throughout the science community. They are used to both collect and analyze all types of data. Therefore, it is important for students in science courses to be exposed to various computer applications and develop the skills they will need to be successful in their careers. During this course you will become familiar with the use of computers in a laboratory environment.

The analysis and reporting of experimental data is an important aspect of working in a scientific laboratory, and *Excel* is one program available to make that analysis easy. *Excel* uses computer applications known as spreadsheets to display, manipulate, and graph collected data. While some may have only used *Excel* to create an organized list of data and an occasional graph, it is the ability to enter formulas in cells and copy and paste these formulas to do multiple calculations at once which makes it a powerful tool in the laboratory. In this lab you will learn (or re-familiarize yourself with) how to do some of the basic calculation and statistical operations in *Excel* and how to create a graphs from the data. The skills that you learn will be applied to other labs and classes in the future.

PROCEDURE

Procedure 1: Using Basic Operations in Excel

*REMINDER: Save your data early and often in order to avoid the accidental loss of your work. Use the following convention for naming your files: "**Lastname Firstname Spreadsheet1**." You may save to the H: drive and/or your own flash drive.*

1. Enter the data in Columns A and B from **Figure 1** onto *Sheet 1* of an *Excel* spreadsheet. Center the values in the columns.

X	Y
126	37
328	67
297	62
423	84
588	98
484	72

Figure 1

2. In Column C, use a formula to add the value in Column A to the value in Column B.

3. In Column D, use a formula to subtract the value in Column B from the value in Column A.

4. In Column E, use a formula to multiply the value in Column A by 5 and divide the product by the value in Column B. Adjust the decimal place so that each answer in Column E has two places after the decimal.

5. In Column F, use a formula that finds the base-10 logarithm of the value in Column A. Adjust the decimal in each answer to three places after the decimal.

6. In Column G, use a formula to calculate the cube of the value in Column B. Express each answer in scientific notation, using two places after the decimal.

7. Label each of the columns to reflect what is happening to X and Y.

8. From the Insert tab, insert a header and footer. Put your name, your partner's name, course number, and lab section in the header. Put the professor's name and the date in the footer.

9. Save your file.

Procedure 2: Using Statistical Operations in Excel

1. Open *Sheet 2* of the same *Excel* file. Design a spreadsheet that would be used to determine the grades of nine students on five quizzes. Place the names of nine students into separate rows and assign grades by entering the scores obtained on five different 10 point quizzes into separate columns.

2. Make a column that calculates the sum of the quiz scores for each student.

3. Make a row below the students' names that show the points possible on each quiz.

4. Make five rows below the rest of the rows that use statistical functions to **calculate** the highest score, median score, lowest score, average score, and standard deviation on each quiz. Adjust the decimal place for the average score and standard deviation to one place after the decimal.

5. Properly label columns and rows that require labels.

6. Save your file.

Procedure 3: Formatting Graphs in Excel

1. Open *Sheet 3* of the same *Excel* file. Enter the data from **Figure 2** in Columns A and B.

Time (s)	$[NO_2]$ (mol/L)
0	1.00E-02
60	6.83E-03
120	5.18E-03
180	4.18E-03
240	3.50E-03
300	3.01E-03
360	2.64E-03

Figure 2

2. In Column C, enter a formula to calculate a base-10 logarithm for each of the values in Column B.

3. In Column D, enter a formula to calculate the reciprocal of the values in Column B.

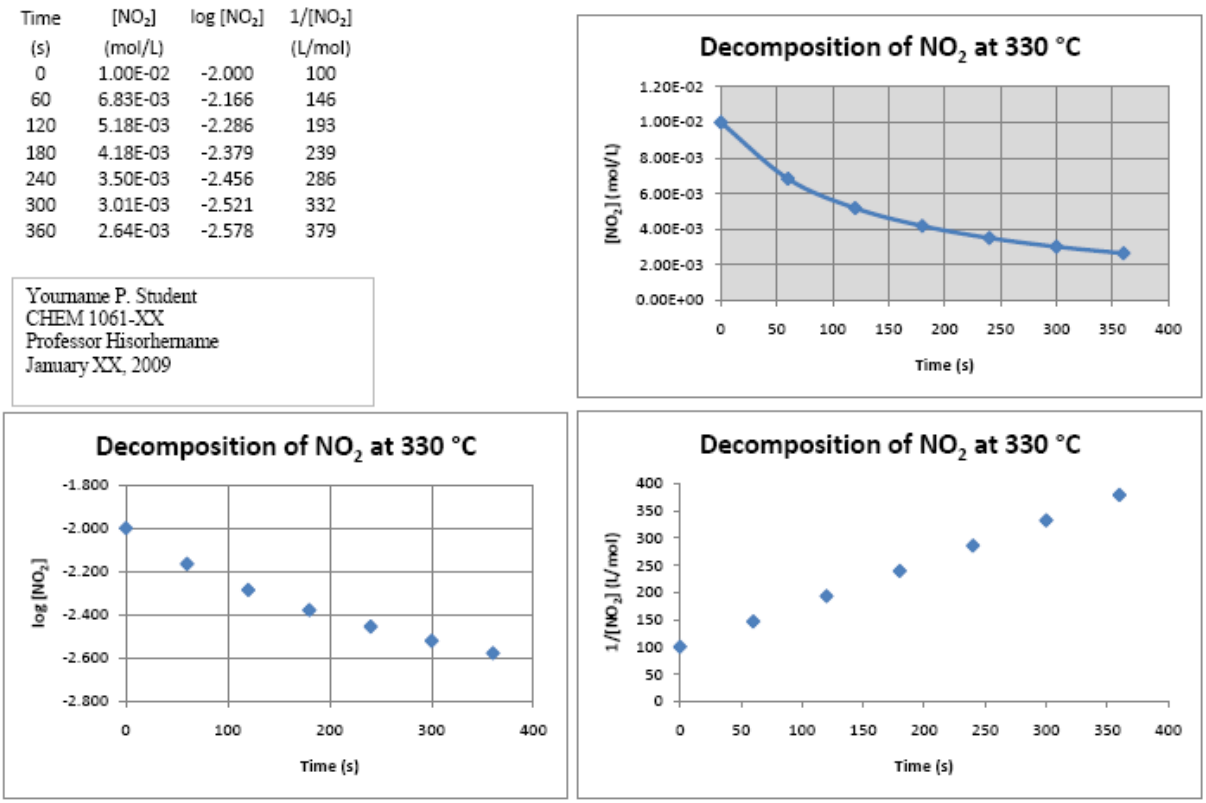
4. In your spreadsheet, go to **Page Layout** tab. Select **Orientation** and then select "Landscape."

5. Prepare three graphs – plotting $[NO_2]$ vs. Time on Graph 1, log $[NO_2]$ vs. Time on Graph 2, and $1/[NO_2]$ vs. Time on Graph 3. Remember to title each graph and label each of the axes. Add vertical and horizontal gridlines as shown on the respective graphs in **Figure 3**. Remove the legend from each graph.

6. Place your name(s), course number, lab section, professor's name, and date underneath your data table.

7. Adjust the location and size of the graphs to be as large as possible, such that the data and the three graphs together fill an entire page (see **Figure 3**). In "Print Preview," your output should look identical to that in **Figure 3**. Identical means that all values should have the same number of significant figures, all graphs should have the same maximum, minimum, and spacing on each axis, same title, gridlines, etc.

8. Save your file.



Time (s)	$[NO_2]$ (mol/L)	log $[NO_2]$	$1/[NO_2]$ (L/mol)
0	1.00E-02	-2.000	100
60	6.83E-03	-2.166	146
120	5.18E-03	-2.286	193
180	4.18E-03	-2.379	239
240	3.50E-03	-2.456	286
300	3.01E-03	-2.521	332
360	2.64E-03	-2.578	379

Figure 3

POSTLAB ACTIVITY

You will be turning in the *Excel* worksheet 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 worksheet. If you are submitting electronically, please use the following convention for naming your worksheet: *Lastname Firstname Spreadsheet1* for an individual worksheet or *Lastname1 Lastname2 Spreadsheet1* for a group worksheet. If you are emailing the worksheet, use a subject line of *Chem 1061: Spreadsheet1 Lab*.

APPENDIX 1: Common *Excel* Functions

Operation	Example(s) of Function Format
Addition	=A1+A2
Subtraction	=A1-A2
Multiplication	=A1*A2
Division	=A1/A2
Powers (x^2, $\sqrt[3]{x}$, etc.)	=A1^2 =A1^(1/3)
Log	=log(A1)
Natural Log	=ln(A1)
Powers of 10	=10^(A1)
$e^{(\text{value in cell A1})}$	=exp(A1)
π	=pi()
Absolute value	=abs(A1)
Sum of values	=sum(A1:A3) =sum(A1,A3,A5)
Average of values	=average(A1:A3)
Median of values	=median(A1:A3)
Lowest value in a range of cells	=min(A1:A3)
Highest value in a range of cells	=max(A1:A3)
Standard deviation of values	=stdev(A1:A3)
Count the number of cells with values	=count(A1:A3)
To make cell coordinates absolute (do not change if copy/paste or drag formulas), add dollar signs	=A4*B2 (in this case, if you drag and paste down a column, the value in cell A4 will always be there—it won't change to A5, A6, etc.—and cell B2 will change to B3, B4, etc.)