ABE 20100 REPORT WRITING GUIDE

Purdue University | Agricultural & Biological Engineering

Report Guidelines
ABE 20100

General Information and Suggestions for Reports

- The purpose of a report is to concisely communicate what you have done in lab to others. You may assume that the reader has some technical training, but do not assume that the reader knows what the assignment was, what you were told in lab, what you were thinking, or how you did what you did. If you were to give your report to someone interviewing you for an internship, would the interviewer be able to understand what you did and what you learned without seeing your lab notebook or asking you questions?
- A considerable amount of judgment must be exercised when writing your reports: the ideas to be discussed and how best to organize these; the detail to be provided; the figures and tables to be shared; the comparisons with theory or other work, etc. It will take a considerable amount of time to make these judgments. Do not assume that you can quickly assemble your report the night before it's due.
- Be concise in your writing. Say what needs to be said but no more. Do not use three sentences when two will do. Avoid being overly verbose.
- Do not use phrases like "The purpose of this lab was…" or "For this lab we…"
- Write with a level of complexity that is consistent with your technical background. You have acquired a lot of knowledge in your studies. Show us what you know.
- Write for an audience that also has a technical background but is most likely not entirely familiar with your project.
- All variables and uncommon terms need to be defined. All acronyms need to be spelled out at least once. However, common terms like psi or mL do not need to be defined.
- *Use your own words* to avoid plagiarism. It is not difficult to recognize when material has been copied and this will be heavily penalized. Do not use direct quotes from your sources; synthesize what you read and put it into your own words.
- Use references where needed. If you state a fact from a source, you need to cite the source.
- Prepare tables, graphs, and figures very carefully. Label all visuals appropriately. See the section on **Report Visuals and Data Display**.
- Cite references appropriately. Look in a textbook or journal article for style examples. See section on **References** for additional guidance.
- *Make your report look good*. Be neat and well organized. Pay attention to formatting. Use headings and sub-headings to let the reader know what they will be reading.
- Write in third person and use past tense. You are explaining what you have done, not what you intend to do.
- Do not begin a sentence with a number (i.e. 10 mL of water was poured into a beaker). Numerals less than ten should be spelled out – unless it is a measured or quantitative value (i.e. Five pressures were measured ranging from 10 psi to 25 psi).
- Include the leading zero in a measured value (i.e. 0.75 mL, not .75 mL)
- Avoid using contractions.
- Use superscripts and subscripts as needed.

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Report Sections

- Your reports should have:
    - **Beginning**
        - Title Page
        - Introduction
    - **Middle**
        - What you did
            - Equipment/software used
            - Development of ideas
            - Development of software or problem solutions
            - Procedures used
            - Data to obtained
    - **End**
        - Data analysis
        - Results obtained
        - Conclusions and recommendations for future work
    - **References**
    - **Appendix**
        - Sample calculations
        - Copies of computer programs
        - Extraneous data or tables

Report Formatting

All reports will be written in Times New Roman 12 pt. font. All pages will be formatted to have 1" margins. The text should be left justified with a line spacing of 1.5.

Look at the rubric for each project report to develop an outline. Place the appropriate material in sections corresponding to the items listed in the rubric. Write descriptive sentences that tell the reader what you did, how you did it, what you found out (data), how you analyzed it, and what you learned (conclusions). Sections should begin and end with transitions that tie the section to the preceding and following sections and enables the reader to understand the material you present.

Report Final Check

- After writing your report, ask yourself the following questions:
    1. Does the report have something meaningful to say?
    2. Does the report stand alone? Is it understandable to someone who did not take this class and attend the labs or to someone who doesn't have access to your lab notebook?
    3. Is the report in a format acceptable to the reader?
    4. Are the ideas organized in a way that makes it easy for your reader to understand?
    5. Have you used an appropriate level of sophistication in your writing?
    6. Does the report look good?
    7. Have you made effective use of figures and tables?

Report Guidelines
ABE 304: Bioprocess Engineering Laboratory
Example for a Title Page

Final Report

EFFECT OF PUMP FORMATION ON THE PRESSURE DROP IN DIFFERERING PIPE CONFIGURATIONS

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April 7, 2016

Report Guidelines
ABE 20100
Formatting for Figures and Tables

Report Visuals and Data Display

Figures

- Graphs
- Sketches
- Schematics
- Process flow diagrams

The caption for a figure should be placed below the figure and should be centered. The caption should be descriptive enough that the reader can understand the figure without referring to the text. All figures should be referenced in the text before they appear in your report. An example, Figure 2 is included on this page. Notice that in the sentence the first letter of the word *FIGURE* is capitalized when referring to a figure. The font for the figure caption should be 1 point smaller than the font for the report text to differentiate the caption from the report body. Notice the stylization of the caption in Figure 2. When referring to your figure, avoid phrases like "as shown on below", "as seen on the following page" because your figure may not always print as intended. It is clear to simply number the figure and refer to it by its number in the text.

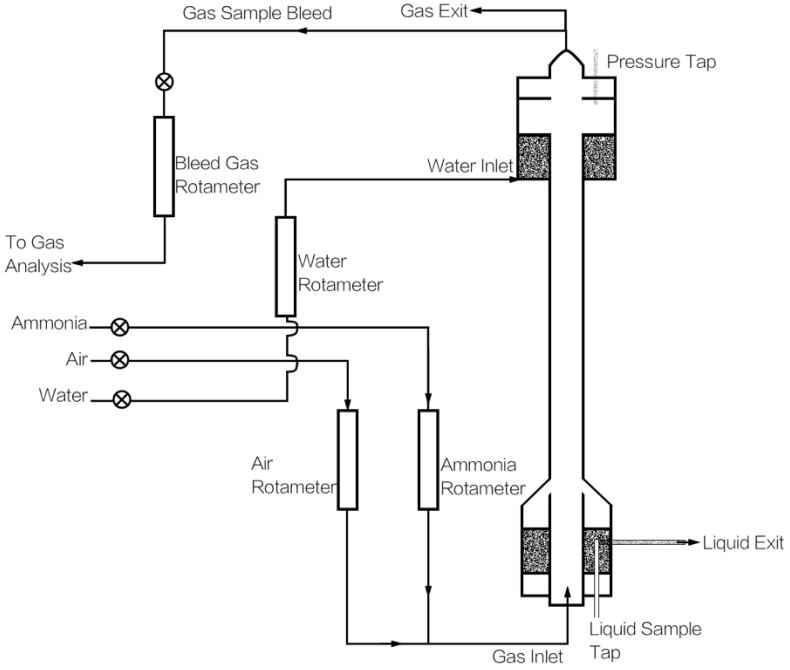

Figure 2: Schematic diagram of the experimental apparatus to measure mass transfer coefficient for ammonia absorption.

Illustrations

1. Do not copy illustrations from any source. You must make your own schematics.
    a. Software suggestions to help construct schematics: MS Visio, MS Powerpoint, MS Paint, lucidchart.com, and digikey.com/schemeit
2. Give the drawing a clear title and a figure number: center the title below the drawing.
3. Label the parts for easy reference. Use arrows if necessary.
4. Depending on the complexity of the drawing, assign numbers or letters to each part with an accompanying key or legend.
5. Include dimensions when necessary.

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Formatting for Figures and Tables

Graphs and Data Presentation

Presenting your data in an accurate and concise manner is required for a quality lab report. It is up to you to figure out the best way to display the data analysis from your lab. Figures 3 and 4 are included as examples of how to present your analysis data. Figure 3 is a representation of a low quality presentation. Figure 4 displays a better way to present data. Both graphs were made in Microsoft Excel. The following list shows why Figure 3 is not the best way to present the data.

- A chart title is given at the top of the graph. This is unnecessary since your reader can clearly see that the graph shows the wall shear stress as a function of wall shear rate.
- The units are not included on the axis title.
- The differences in the data series are shown by color difference only. This will not work is your report is printed in black and white.
- The legend takes up a lot of space on the right hand side.
- The grid-lines are distracting.
- The caption leaves a lot to be desired. The figure caption should be descriptive and should allow your figure to stand-alone from the text. Your figure caption should convey the following information:
    - What does the graph show?
    - Why is it important?
    - What conclusion can be drawn from the graph?
- The inclusion of regression equations is distracting; they are small, improperly placed, and contain too many significant digits. The importance of fitting the data to an equation is not given in the descriptive caption.
- Acronym LBG is not defined.

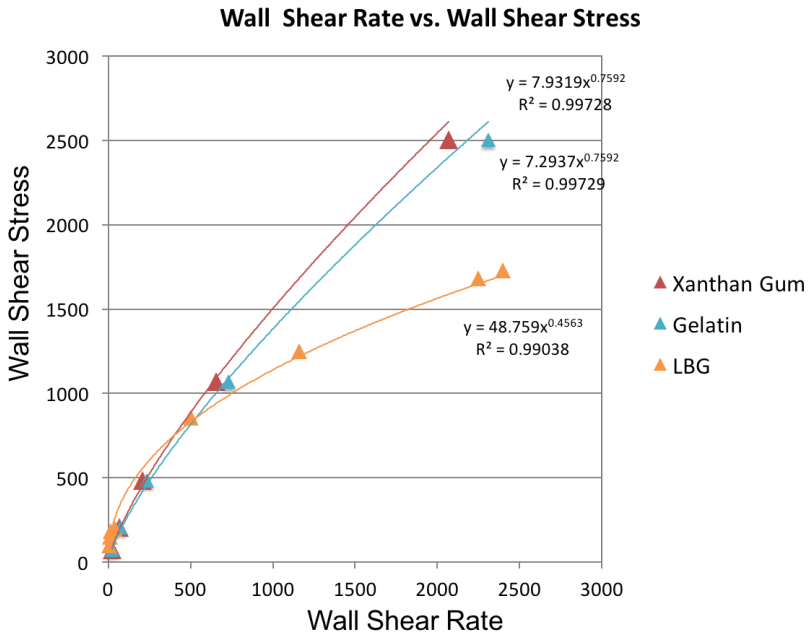

Figure 3: Wall shear rate as a function of shear stress. The red triangles show the xanthan gum, the blue shows the gelatin and the orange is the LBG. The data fit well to show shear thinning behavior and the equations show the consistency index and the flow behavior index.

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Formatting for Figures and Tables

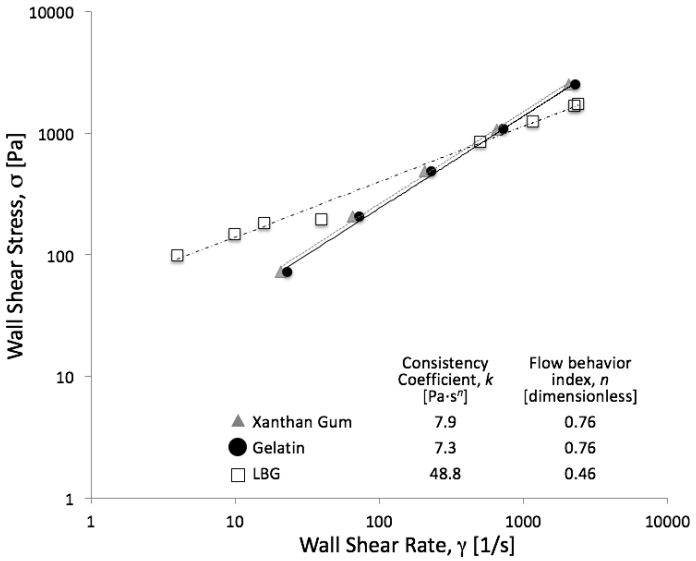

Figure 4: Behavior profile for xanthan gum(▲), gelatin (●) and locust bean gum (□) determined using a capillary flow viscometer at room temperature (22˚C). The profile was plotted as a log-log plot to demonstrate the linear relationship between. Linear regression was performed to determine the fluid type; all regression lines had an R^2 value >0.98. The three solutions all exhibited shear thinning behavior and was verified using the value of the flow behavior index, *n*, which was <1 in each case.

Tables

- Tables of information or data

The caption for a table should be placed above the table and should line up with the left side of the table. The caption should be descriptive enough that the reader can understand the table without referring to the text. All tables should be referenced in the text before they appear in your report. An example, Table 1 is included on this page. Notice that in the sentence the first letter of the word *TABLE* is capitalized when referring to a table. The font for the table caption should be 1 point smaller than the font for the report text. Notice the stylization of the caption in Table 1.

Table 1: Experimental results for K_{og}. The flow rate, Q, was the independent variable and ranged from 70 to 150 L/min.

Q [L/min]	U [m/s]	L [L/min]	K_{og} [mol $NH_3/m^2 \cdot s \cdot atm$]
70	2.42	0.80	0.78*
90	3.12	0.80	1.00
110	3.81	0.80	1.09
130	4.41	0.80	1.21
150	5.19	0.80	1.37

*A sample calculation to find this result is found in the sample calculation section of the appendix

Special note: Take note of the significant figures (SigFigs) in your reports. Many of you calculations will be performed and reported using Microsoft Excel, which will gladly spit out as many SigFigs as you want. However, this is not good practice; especially when reporting on experimental data. If the tool you use in the lab is only able to measure one SigFig, then you can only report one SigFig in your analysis. If the tool you use is able to report three SigFigs, then you can use three SigFigs.

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Formatting for Figures and Tables

Equations

If you add an equation to your report, you need to refer to it in the text. This is much like you find in a textbook. You must number your equations. An example is shown in Equation 1. Notice that in the previous sentence the first letter of the word *EQUATION* is capitalized when referring to an equation in the text. The equation should be tabbed to start at 2" in from the left margin and the designation number should be right justified as shown in Equation 1. Do not forget to explain the terms in your equations.

$$K_{og} = \frac{W}{a \cdot z \cdot \mathrm{D}P_{LM}} \qquad (1)$$

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Formatting for Figures and Tables

References and Citations

Content

References are used to help your reader understand where your information is originally from and allows them to look up the reference in case they would like additional information. If you read something and then use this information to help write your report, it should be referenced at the end of the sentence. You need to put what you read into your own thoughts. Using more than a few words from a source is considered plagiarism and should be avoided at all costs. The Purdue OWL (Online Writing Lab) is an excellent resource regarding what is plagiarism and how to avoid it. The OWL can help you with citations and references.

For this course, you are expected to use authored resources for your citations. You may not use the pre-labs, presentations, or lab manuals as a source in your reports.

1. Only scientific journals, reference books, textbooks, official government publications (e.g. USDA, FDA, CDC, NIH, EPA, etc.) should be used as references for technical content in your reports. Company websites are acceptable for citing where product-specific information was obtained (e.g. nutritional information, packaging, serving size).

2. Do NOT use websites such as eHow, Wikipedia, EngineeringToolbox as your source. There is no guarantee that information on these sites is correct. Some of it can be wrong or misleading. You would never want to reference these types of sites in any sort of professional output. As a student, wrong or misleading information can significantly undermine your learning.

Formatting

In text citations should be formatted as follows:

> Liquid-liquid extraction is employed when a component of interest in a mixture can be removed by a component using a second liquid phase (Geankoplis, 2010). A method that lends itself to a larger scale and uses water as an effective extraction solvent is pressurized liquid extraction (PLE), or sub-critical fluid extraction. PLE uses liquids at an elevated temperature, below the critical point, which enhances the extraction kinetics of the solvent and uses increased pressures to keep the solvent in liquid form (Wang and Weller, 2006). Water is a more effective solvent, for extracting organic compounds, when under pressure and at elevated temperatures because, as the temperature of water increases yet still remains below its critical point, the dielectric constant of water decreases, which leads to a decrease in the polarity of water (Ong *et al*., 2006). Organic compounds are more soluble in less polar solvents, thus making sub-critical pressurized water a better extraction solvent for many natural products (Shotipruk *et al*., 2004).

The resulting references in the literature cited would be formatted as shown below.

Geankoplis, C. (2010). *Transport Processes and Separation Process Principles*. Upper Saddle River, NJ: Prentice Hall, pg 776.

Ong, E. S., J. S. H. Cheong and D. Goh (2006). Pressurized hot water extraction of bioactive or marker compounds in botanicals and medicinal plant materials. Journal of Chromatography A, 1112(1-2): 92-102.

Shotipruk, A., J. Kiatsongserm, P. Pavasant, M. Goto and M. Sasaki (2004). Pressurized hot water extraction of anthraquinones from the roots of *Morinda citrifolia*. Biotechnology Progress, 20(6): 1872-1875.

Wang, L. J. and C. L. Weller (2006). Recent advances in extraction of nutraceuticals from plants. Trends in Food Science & Technology, 17(6): 300-312.