GUIDELINES FOR PREPARATION OF LABORATORY REPORTS

The following guidelines emphasize thoughtful data presentation, clear analysis, and concise discussion of methodology and results. When the labs are graded, points will be allocated based on the information provided with the individual lab handouts. To receive the maximum number of points, please follow these guidelines. Additional guidelines are included with the individual Lab Handouts. Those guidelines are meant to clarify and complement, not replace, the instructions here.

1) Introduction: Include a brief introductory paragraph stating the topic of the laboratory exercise and the overall purpose of the lab (e.g. examine the behavior of a Venturi meter and the relationship between volumetric flow rate and pressure drop across the meter). Introduction: A good start to an introduction is: "The aim of this laboratory exercise was to..." In the introduction, it's helpful to talk about the point of the lab and the fundamental principles involved. You may also include discussion about the experimental set-up here.

2) Data sheet: Include dated, original sheet(s) with lab times and/or sections. The number of digits you report should reflect the level of confidence in the measurement. If you are reading an analog scale, it is generally assumed that you can read the smallest gradation accurately, and that you can make a reasonable interpolation between two gradations. Thus, if a ruler scale is shown with gradations in mm, it is assumed that you can make a reasonable estimate of a reading to ± 0.1 mm, by interpolating between two gradations. If your measurement is quantified by an electronic meter, the reading on the meter is considered accurate to the last stable digit. Thus, if a meter reads 1.13 and is stable, you can report the value as 1.13. Similarly, if it constantly fluctuates between 1.10 and 1.16, it is reasonable to report a value of 1.13. However, if it fluctuates between 1.00 and 1.30, you should only report the value as 1.1 or 1.2, because even though the meter has two digits after the decimal point, you can only be confident of the accuracy of the "tenths" digit.

3) Schematic: A diagram of the apparatus, including where sampling took place.

4) Calculations: Present at least one complete detailed hand calculation for each variable requested in addition to a tabular summary of all results. If you wish to present many pages of repetitive hand calculations, put them in a technical appendix so they do not interrupt the flow of the report. If you use a computer program such as Excel to perform an analysis (e.g. linear regression), reference the computer program along with the specific program options used.

There are detailed rules about how many significant figures to retain when numbers are added or multiplied. For our purposes, acceptable rules are as follows: (1) the result of an addition or subtraction should only have significant figures up to the "column" where all the numbers being added or subtracted have significant figures. In other words, if a number with significant figures through the "tenths" column is added with another that has significant figures up to the "thousandths" column, the result can only have significant figures to the tenths column. If numbers are multiplied or divided, the number of significant figures in the result is the same as that in the number that has fewest significant figures of any in the calculation. For example, multiplying 2.1*3.44 yields 7.2, not 7.224 (no matter what you calculator says!). Note that pure numbers (like the 2 in 2gh) are assumed to be known exactly, and hence have infinite implied significant figures.

Extraneous digits have no validity and give a false impression about the reliability of the result. make no sense, especially given the precision of the instruments we use.

5) Figures: Figures (both schematic drawings and graphs) must be labeled and given a title, e.g. "Figure 1. Schematic of Air Duct." In addition to the title, graphs must have their axes labeled, with units included. It is best to identify both the "long name" of the parameter being plotted and the symbol that is being used to represent it in equations in the text; units can be shown in parentheses or brackets after the name, e.g. Flow Rate, Q [m^3/s]. If the name is too long to include on the axis, it can be left out, but then it should be included in a note after the title. Note that if a variable is squared or is otherwise altered, the units are altered in the same way, e.g. the units of Q^0.5 are (m^3/s)^0.5, or m^1.5/s^0.5.

When referring to a plot of "Parameter 1 vs. Parameter 2," the convention is that the value on the y axis is always stated first. Thus, if the lab write-up requests a "Q vs. M" graph, the graph should have Q on the y axis and M on the x axis.

Finally, all figures must be referred to in the text. Figures can be referred to either parenthetically, e.g. "The duct had a rectangular cross-section and was 5 m long (Figure 1)" or more directly, e.g. "Figure 1 is a schematic of the equipment used to conduct this experiment." In addition to indicating when you want the reader to look at the figure, you need to let the reader know what you think the figure demonstrates. If the figure is just a schematic, then indicating that it represents the experimental setup or something similar is adequate. However, if the figure is a graph, you need to say something like, "The figure demonstrates that the flow rate is proportional to the square of the pressure difference, as is expected from theory," or "Based on the y-intercept of the curve shown in Figure 3 and Equation 5-2 in the Munson text, the elevation difference is estimated to be 1.5 m."

6) Discussion: In the discussion, answer any questions asked in the laboratory handout. Discuss the results of your calculations, indicate whether they matched the relevant theory, and suggest explanations for any discrepancies. Always discuss measurement error; a paragraph will usually suffice. You have at least a few simple ways to estimate errors. For example, you can estimate what is the smallest scale mark you can reliably read off the instrument and express that as a percent of the average reading (e.g. you can measure the velocity to within 2% of the observed value). Try to be realistic -- if there were sources of significant error that you can identify, state them, but don't speculate wildly about possible errors that you have no real reason to believe.

7) Conclusion: The conclusion should be a concise summary of the key findings, stating whether the objectives of the lab were achieved and how well the results matched the expectations.