

Lab Reports

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1. General Information about the Lab Reports and Lab Manual

- While the precalculations are done individually, the lab reports are done as a group (one for each lab per group of two or three students). The assigned grade for the **Lab Report – Group Portion** will be the same for each group member.
- Lab reports are due at the beginning of the first class period following execution of the lab (at the start of the next lab period, typically one week after completion of the experiment).
- The lab report must include all the pages from the lab manual relating to the experiment, including the Cover Page, Procedure, Results, and Discussion, along with any additional figures, tables, or plots as required. The report must be stapled or clipped together.
- Only one copy per group of the section of the lab called “Lab Report – Group Portion” is required.
- The lab manual for each lab experiment contains questions that are to be answered by the students in the provided space. The weight for each question is shown in parentheses to the left of the question.

2. Specific Details about Lab Report Writing and Grammar

- Figures, tables, and plots generated on additional sheets of paper should be clearly labeled, titled, and numbered, (e.g. “Table 4. Head loss measurements through a 3/4-inch copper pipe.”), referred to in the report (e.g. “...See Table 4 ... See Figure 7 ...”), and attached to the report immediately following the page on which they are first referred.
- Approximately 10 percent of the lab report grade is given for neatness and grammar. Particular items about which to be careful include:
 - The subject and verb must agree. (“A group of tests was performed ... The data were plotted ...”)
 - “Data” is a plural word. (“Data were recorded at two downstream locations ... these data are plotted ...”)
 - “Reynolds number” is named after Reynolds, not Reynold, and is *not* written as “Reynold’s number”.
 - The plural word “they” should not be used as a neuter singular subject. (Incorrect: “If a student does this, they will learn that ...” Correct: “If a student does this, he or she will learn that ...”)
 - Don’t leave “dangling participles” or “dangling prepositions”. (Incorrect: “I left my hat on the chair I sat at.” Correct: “I left my hat on the chair at which I sat.”)
- Units must be included in all calculations in the lab reports.

$$\text{Re} = \frac{Vd}{\nu} = \frac{(45.6 \text{ m/s})(0.1016 \text{ m})}{1.750 \times 10^{-5} \text{ m}^2/\text{s}} = 2.65 \times 10^5$$

correct

$$\text{Re} = \frac{Vd}{\nu} = \frac{(45.6)(0.1016)}{1.750 \times 10^{-5}} = 2.65 \times 10^5$$

incorrect

When grading the lab reports, points will be deducted if units are not shown in the calculations.

- It is incorrect to report numerical values to more than the maximum number of significant digits of precision associated with any one measurement. In the lab experiments, the typical precision varies significantly from instrument to instrument. For example, if velocity V is measured as 45.6 m/s (3 significant digits), diameter d is measured as 0.1016 m (4 significant digits), and kinematic viscosity ν is interpolated from a table as $1.750 \times 10^{-5} \text{ m}^2/\text{s}$ (4 significant digits), the Reynolds number would be precise to only three significant digits:

$$\text{Re} = \frac{Vd}{\nu} = \frac{(45.6 \text{ m/s})(0.1016 \text{ m})}{1.750 \times 10^{-5} \text{ m}^2/\text{s}} = 2.65 \times 10^5$$

correct

$$\text{Re} = \frac{Vd}{\nu} = \frac{(45.6 \text{ m/s})(0.1016 \text{ m})}{1.750 \times 10^{-5} \text{ m}^2/\text{s}} = 2.647406 \times 10^5$$

incorrect

Although a calculator may have 8 or 10 digits, only the first three digits are meaningful in this example! When grading the lab reports, points will be deducted for use of excessive number of digits.

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3. Specific Details about Figures and Tables

- When data are generated with lots of scatter, data points should *not* be connected on a plot by straight lines as one might do for a Dow-Jones stock market plot. The ups and downs in experimental measurements are usually caused by non-repeatable inaccuracies, and should *not* be emphasized. Instead, a smooth curve (or straight line if the data warrant one) should be drawn through the points. Figure 1 shows examples of both correct and incorrect ways to plot scientific data with scatter:

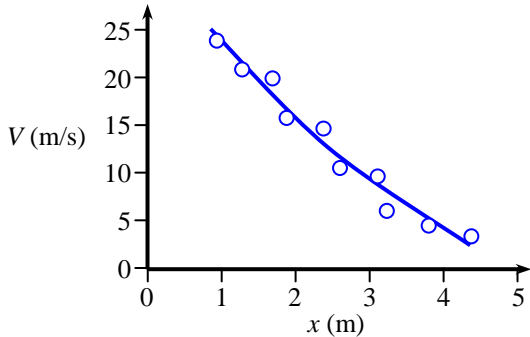


Figure 1. Correct plot of scattered data.

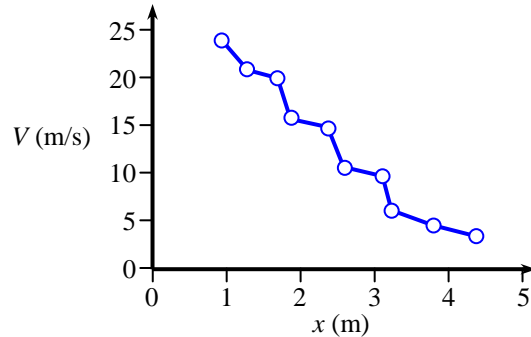


Figure 2. Incorrect plot of scattered data.

- When generating tables of results, units must always be included as part of the caption for each column. Care must be taken when using exponents in tables. This is a common mistake. Suppose for example that there is a column of data for kinematic viscosity ν in units of m^2/s , with calculated values of $1.45 \times 10^{-4} \text{ m}^2/\text{s}$, $1.83 \times 10^{-4} \text{ m}^2/\text{s}$, $2.65 \times 10^{-4} \text{ m}^2/\text{s}$, etc. Table 1 shows both correct and incorrect ways of tabulating these data:

Table 1. Correct and incorrect ways of tabulating data.

$\nu (\text{m}^2/\text{s})$	$\nu \times 10^4 (\text{m}^2/\text{s})$	$\nu \times 10^{-4} (\text{m}^2/\text{s})$
1.45×10^{-4}	1.45	1.45
1.83×10^{-4}	1.83	1.83
2.65×10^{-4}	2.65	2.65
⋮	⋮	⋮
⋮	⋮	⋮
⋮	⋮	⋮
correct and preferred	correct but not preferred	incorrect

Notice that the first column is preferred because there is no possibility of confusion. The second column is correct, but confusing because some readers may erroneously interpret the first value as $1.45 \times 10^4 \text{ m}^2/\text{s}$, rather than the intended $1.45 \times 10^{-4} \text{ m}^2/\text{s}$. Note that the proper way to interpret the second column is as follows: The numerical value listed (according to the column caption) is actually the value of ν multiplied by 10^4 . Thus the first value is 1.45 divided by 10^4 , i.e. $\nu = 1.45 \times 10^{-4} \text{ m}^2/\text{s}$, which is correct. The third column is clearly incorrect, but can also be confused. To play it safe, numbers should always be tabulated as in the first column to avoid confusion!

- The convention for figure and table captions is as follows:
 - Figure captions are placed *below* the figure.
 - Table captions are placed *above* the table.

Proper placement of captions is illustrated in Figures 1 and 2 above, and in Table 1 above.