Introduction

The purpose of the checklist is to try and develop uniform expectations for labs. All of the requirements are in order to make your work *professional*.

Explanation

General

- *Your own work*

  The goal of education is that each individual will learn. The less one does oneself, the less one learns. I *know* how the experiments work; they are for your benefit, not mine.

- *Complete*

  All things are requested for a reason; parts not done will reduce the learning involved.

- *Clear and appropriate "Purpose"*

  You should have a clear idea of what you are trying to achieve, so you can conclude whether or not you succeeded.

- *Flows*

  A lab *report* should not be just a string of calculations. There should be sufficient text so that if you came back to this report next year, you would be able to follow it.

- *Did not require help on or after due date*

  Good planning and time management are essential.

- *Good grammar*

  By the time you are in university, this should not need to be justified. Your credibility will depend on your attention to detail. If you cannot communicate clearly and correctly, pepul wil beleave u r a doofus.

- *Correct spelling*

  This is like the previous point.

- *Complete sentences where required*

  Your goal is to *communicate* results, not merely record numbers, etc.

- *Legible*

  By the time you are in university, this should not need to be justified.

- *Professionally presented*

  A professional report is not submitted on tractor–feed or non–standard size paper, but it is typed, firmly bound (eg. stapled), neat, etc. (Equations can be *neatly* handwritten).

- *Properly identified (eg. name, partner)*

  Print your name and your partner's name, your student numbers and your lab section, along with the due date.

- *On time*

  To do this, you should aim to have the report finished and printed by the day before the due date so that if any problems occur you have time to fix them.

- *Checklist included*

  A blank checklist must be attached to the report for the marker to fill in.

- *Template included*

  The template which was signed in the lab, *not a copy*, must be included to verify that you were actually present in the lab.

Data (For data not in tables)

- *Your own data*

  The goal of education is that each individual will learn. The less one does oneself, the less one learns. I *know* how the experiments work; they are for your benefit, not mine.

- *Values recorded with uncertainties*

  "Voltage = 1.023 ± 0.004 Volts"

- *Sufficient data*

  If you have to choose how much data to record, make sure there is enough to do all that you need to do with it.

- *Reasonable values*

  eg. "Diameter = -6.5 *cm*. WAIT! This can't be! Diameter should be positive."

- *Reasonable uncertainties*

  Your uncertainties should be neither way too big or too small; they should be determined by the actual limitations on your data, not simply by recording "1/2 the smallest division" for every instrument. How these values were arrived at should also be stated.

- *Correct number of significant figures*

  Last digit of quoted value should be uncertain. eg. "Voltage = 1.023 ± 0.004 Volts" Note the 3 is uncertain. Both "Voltage = 1.02 ± 0.004 Volts" and "Voltage = 1.0235 ± 0.004 Volts" would be *wrong*.

- *Units recorded*

  eg. "Voltage = 1.023 ± 0.004 " is not OK.

Data in Tables

- *Neat*

  Tabular data should be in boxes, with no page breaks within a table. Tables should not be split into multiple sections without reason, etc.

- *Column headings informative*

  "y" and "x" don't help much here either

- *Units given*

  Usually these should be part of column headings.

- *Uncertainties given*

  Error bars on graph should be easy to verify with values in the table

- *Label*

  Labels should be meaningful; eg. "Mass sliding down incline" rather than just "Data" or "Part 3"

- *Number given (eg. "Table #2")*

  ..and then any reference to the data can use this number.

Least Squares Fits

- *Points used for fit clearly identified*

  if all data points are not used, it should be clear which ones *are*

- *Results given meaningful names*

  "st. err. of coeff." is meaningless; "slope" is meaningful

  if you don't know what some calculated quantity means, don't present it

- *Correct units for slope and intercept*

If the graph axes have units, the slope and intercept must have units.

- *Correct indication of "large" or "small" scatter*

  Whether to use standard errors or maximum and minimum slopes for the uncertainty must be indicated.

Graphs

- *Title meaningful*

  (not "y" vs. "x"); the title should give information otherwise NOT on the graph

- *Correct graph type and orientation*

  with rare exceptions, all graphs will be "xy" type; if an orientation is specified, such as "y" versus "x", then the dependent variable, eg. "y", should be on the *vertical* axis and the independent variable, eg. "x", should be on the *horizontal* axis

- *Plotting data in table*

  The quantities plotted on the graph should actually be recorded. (eg. if you have "diameter" as a graph variable, but you measured "radius", you should have "diameter" in a table so it's easy to compare what's plotted with what's written.)

- *Axis labels meaningful*

  "distance" is more meaningful than "x"

- *Correct axis units*

  The units should make sense for the quantity in the label

- *Points not connected*

  your graphs should never look like dot–to–dot drawings

- *Error bars in both dimensions or note if too small*

..in both dimensions, or there should be a note on the graph if they are too small to show up in either dimension

- *Error bars correct size*

  This is why uncertainties are in the data tables; it should be easy for a reader to check that the table and graph agree.

- *Line of best fit shown without markers*

  there should be no suggestion that points used in plotting the line of best fit are data points

- *Number given (eg. "Graph #3)*

  ..and then any reference to the data can use this number.

Calculations and Results

- *Any required derivations done correctly*

  Watch for instructions to "show", "derive", etc.

- *Analysis explained where needed*

  calculated values should not appear out of the blue;

- *Correct formulas used*

  this of course presumes the formula is actually *stated*

- *Sample calculations shown where needed*

  show one sample of any non-trivial calculation

- *All required values calculated*

  Be sure to find all of the results asked for.

- *Uncertainties included*

  Make sure all results have bounds on them.

- *Units included*

All results should have units stated unless they are some of the *very few dimensionless numbers.*

- *Correct number of significant figures*

  this will be easier to get right after you put results in...

- *Appropriate use of standard form*

  eg. "Voltage $= 1.023 \times 10^5 \pm 4 \times 10^2$ Volts" should be written as "Voltage $= (1.023 \pm 0.004) \times 10^5$ Volts" (but standard form should not be used if there are no placeholder zeroes.) A better way to write this would be to avoid the standard form by writing "Voltage $= 102.3 \pm 0.4$ kilovolts" since it is the most concise and easy to interpret.

- *Theoretical or reasonable value*

  Either compare to something expected OR give some rationale for whether this is in a reasonable ballpark.

- *Agreement of experiment with theory*

  This should be done in cases where the previous rule does not apply, eg. in testing "laws", etc.

- *Questions reasonably answered*

  This refers to explicit questions in the manual

Error Discussion

- *Sources listed are significant*

  The goal is to suggest things that may have had a noticeable effect, not just whatever you can think of; you're trying to *support* your results, not destroy them

- *Sources are prioritized*

  Most emphasis should be placed on factors which produce greatest uncertainty on your results.

- *Correct explanations of consequences of systematic errors*

  If systematic errors are discussed, then the effect on final results (ie. to make quantities bigger or smaller) should be noted, and comments should be made about whether that makes sense from the results. *Note: You must include at least one source of systematic error to discuss, even if you show that is is small enough that it can be ignored.*

- *Evidence: ie test where possible or bound where can't test*

  You should indicate some concrete test or rationale for how big the effect may be; if you did not see any *concrete* evidence for a source of error, you should NOT use it.

- *Reasonable suggestions for improvement*

  ..if you found something with an apparently noticeable effect

Conclusions

- *Relate to purpose*

  What you conclude should be related to the things you said you were going to study, observe, etc.

- *Major results stated*

  These are usually the final quantities things you were supposed to calculate.

- *Comparisons made where appropriate*

  How do your results compare to accepted values, etc.? Do your results agree within experimental error? If you have no accepted value, were the results *plausible*?

- *Agreement noted when found*

  This is the whole reason for calculating uncertainties. (If quantities don't agree, see below.)

- *Percent difference calculated only when quantities don't agree*

  If quantities agree, then see above.

References

- *Source(s) of constants listed*

  Since you are not writing an *Introduction* section for your labs, there are not many references for your lab reports. However, when you have to look up constants then you should cite your sources for them.

Methods

- *All steps clearly described*

- *Paragraph format*

- *Past tense*

Introduction

- *Rationale for research given*

- *Historical/experimental context given*

- *Good references*