Lab books

Students are required to keep a lab book for their laboratory work. A lab book is simply a "diary" of the procedures done in the lab and the results obtained. It does not have to be a work of art; it can contain crossed-out sections (most lab books do); and it does not need to explain results (as a lab report does).

Why is the experimental lab book important?

- It enables a complete reconstruction of the experiment and measurement at a later date.
- It enables the work to be repeated for re-evaluation of the reported results.
- The steps that led to the success or failure of a large project can be extracted.
- Patent lawyers need properly documented evidence of inventions.

What kind of book for a lab book?

- A bound notebook with numbered pages is essential -- so that alterations, removals, and additions, are difficult to make at a later date.
- It should have both ruled and graph pages, so you can plot your results easily or draw a block diagram.
- The notes should be legible, in non-fading ink or pencil, and written as the calculation, measurement, and analysis proceeds, not afterwards from memory of what happened or from bits of scrap paper.

Truth in reporting observations and experiments

Results should never be massaged to improve their fit with theory or calculation. Negative results are as important as positive results. Facts should be recorded without comment, opinion can be expressed in an analysis section. Uncertainties should be noted, non-repeatability recorded.

What should be recorded in the lab book?

In general, anything which allows someone else to repeat what you did in the lab.

- The date and time. This should be recorded during the lab period and whenever you start to write something new.
- There should be a section for preliminary calculations and schematics. There should be mention of preparatory work for each step of the lab.
- Each step of the lab should be clearly labeled ("circuit", "measurement of this", etc.).
- Parameters or conditions that might affect the outcome of the experiment.
• Equipment used, type and model numbers (e.g., Keithley 195 DMM), any calibration steps taken.
• Sketches of experimental layout and traces on recorders, oscilloscopes, spectrum analyzers etc.
• The names of other people observing (and you partner). References to other people's work, ideas, hints, and inputs.
• Rough error analyses taken during the experiment, repeat observations of doubtful readings, calibration errors allowed for.

Data recordings

Lab books record data as well as methods. The data should be ordered and logical. Large amounts of data must be organized in tables. The instrument used should be recorded (e.g., as a foot note at every column of data), with an indication of the precision and the range setting of the instrument. Range changes should be noted.

It is most important to preserve the raw data. The processed data should be clearly separate, so that a calculation error can be spotted and corrected at a later date.

Miscellaneous

It is a good idea to use the same color ink throughout a particular unit if not the whole lab book. There is nothing wrong with adding notes and explanations after the lab period is over. A good way to do this is to then write these notes in a different color of ink. Be sure to put date and time next to any new notes.

You should aim to do a preliminary data analysis (process and plot the data) immediately after you take the data, still in the lab. This is a very important habit to acquire as it is often the quickest way to spot systematic error or mistakes in your procedure. You will find that the time taken to do this is repaid in time saved by not taking great strings of erroneous data and not being able to repeat the erroneous measurement.

Labeling of data plots is very important: always label the axes (what quantity is plotted on each axis), indicate scale and units of measurement. Each plot and diagram must have a title (e.g., "Resistor current vs. applied voltage"), and preferably a brief explanatory caption, like in a book. Charts, photographs, and printer output from the experimental apparatus should be cut and glued in the lab book wherever possible. The originals should be used wherever possible. Date and time should be recorded often.