The lab book: Essentials to record-keeping in science.

Lab books are a big part of science, it is the complete record of what was done, when it was done, how it was done, and who did it. This is important because if your experiment or procedures were to be repeated, your lab book should provide all the information necessary to replicate and validate your results. Here are the bare essentials for a lab book:

Title page for the lab book:

- Full name
- Contact information (phone number, email address)
- Year started and finished
- Project name (or projects associated with the lab book)
- Labs mailing address
- Name and contact information for your principal investigator

Entries should include:

- Title of the test
- Date and time
- Hypothesis or goal
- Background information
- Reference to the protocols or SOPs used
- Note the equipment and materials used
    - Settings and serial numbers
    - Catalog numbers, source, expiration date)
- Deviations
    - Their nature and why they occurred
- Personnel involved and their responsibilities
- Observations, results and raw data (results)
    - Print-outs, notes, photos, etc. All electronic files should be printed and attached to your notebook.
- Software used
- Analysis

Overall lab book requirements:

- Keep a running table of contents (number each page)
- Bottom of each page should be signed and dated by a supervisor
- Always write in pen

What lab book should I buy?

The lab book itself also has requirements for how it should look, and for good reason. A lab book needs to be bound or stitched, this is because if you were to use a binder, or a spiral

bound notebook any trace of a page could disappear. This would bring into question if data, trials or anything was missing and therefore, ruin the integrity of the studies being conducted. If you happened to transcribe your data outside of your lab book before getting around to actually writing in your lab book, then you should copy everything over but also keep the original. Or just glue in the original. If you do this make sure to strike a line through the side of the sheet onto the lab book page with your initials and the date.

What should I write with in my lab book?
Make sure to write neatly and legibly in pen, never pencil. That is because pencil can be erased and smudged easier. Since the legibility, and accuracy of your lab book is very important to the science that you are doing, it is best practice to avoid this and use a pen instead.

What if I mess up writing in my lab book?
Another good practice is if you need to make corrections to your lab book make sure that you don't scribble in your lab book! Strike the error with a single line, write the correction (with a brief explanation) and add your initials and the date you made the corrections.

What if I messed up my procedures?
When it comes to reporting deviations and errors it is important to be as thorough as possible because these could be great clues for later if you need to figure out what went wrong. Include all observations, even if they seem minor, including color, etc. You should always be completely transparent about any errors you make. Any incorrect documentation would bring the validity of your experiments or studies into question and could have significant consequences (regulatory penalties, patent applications could be rejected).

Following the same sentiment you should also always include all of your data, the good and the bad. Then you should describe what happened as well as you can. This is because if you were to be investigating a reaction, you could have made a new discovery by accident or have seen something that suggests something by accident. Or if you were in a manufacturing environment, any data needs to be taken into account when releasing a product.

Some personal preferences:
When it comes to writing all your observations, sometimes there's a lot to mention and not a lot of space to write it. Some people like to have entire pages set aside for observations, for example the left page is always left for observations and the right is for everything else (procedures, results, etc.). Others like to divide their pages prior to starting, giving a margin of each page for their observations. How you incorporate observations into your lab book is up to you!

What to do with blank space in your lab book:
When finishing writing in your lab book for the day or beginning the following day, if you choose to use a fresh page but there was space left on the previous page, make sure to cross out this vacant space. This ensures that no data, etc. can be added later, and helps to maintain the integrity of your lab book. This is also why you should not be leaving entire pages blank as well.

How to start your own lab book:

1. Find a bound or stitched notebook. Grab a pen!
2. Create your title page. Make sure to include:
    a. Your full name
    b. Your contact information (phone number, email address)
    c. The year (and make sure to leave space for later when you finish it)
    d. Your project name (or projects associated with the lab book)
        i. If you have multiple lab books for your project make sure you incorporate which lab book number you are on.
    e. Your labs mailing address
    f. The name and contact information for your principal investigator
3. Leave a few pages blank after the title page for the table of contents. This is important because it will give you ‘quick access’ to your important information/procedures later.
4. You can choose to number pages as you go or you can number them all now. Most people like to number the top right corner of each page.
5. Time for your first experiment? Let's get started on your first entry! It should include:
    a. Title of the test or procedure you are running today
    b. Date and time
    c. Hypothesis or goal
    d. Background information. This can be brief but it should explain why you are running the experiment or procedure you are doing today.
    e. Reference to the protocols or standard operating procedures (SOPs) used. You don’t have to write out the whole procedure word for word but providing which you used will give your reader the information they need to find out what you did.
    f. Note the equipment and materials used (Note some people like to keep a few pages of their lab book for the equipment and materials that they use the most so they can avoid re-writing the same information often).
        i. Settings and serial numbers
        ii. Catalog numbers, source, expiration date)
6. Deviations. Deviations are things that happened, expected or not, that were not a part of the protocol you initially began. Examples of this is if you had run out of the reagent you needed and you decided to replace it with a reagent with similar properties. Or perhaps something happened in the lab and a step of your procedure was delayed. These are changes that could have an impact on the final product.
    a. Explain their nature and why they occurred.
7. Personnel involved and their responsibilities. If there are people other than you involved in this procedure make sure you reference them so that if the product is off at the end you know to check their lab book to see if they had any deviations that could have caused the issue.
8. Observations, results and raw data. This section is very important and so is its completeness. There is no point to recording anything if you don’t know what the final result of the procedure was. If you have used any electronic resources or software, you need to make sure to include that as well (print out and reference to where the digital file

can be found). Normally, labs have a hard drive or something for all relevant data to be uploaded for long term safe keeping. When completing research this is important because other labs scientists reading your published papers may want to inspect your data as well.

   a. Print-outs, notes, photos, etc. All electronic files should be printed and attached to your notebook.
   b. Note that your observations can be formatted in many different ways. You could divide each page prior to starting your experiment to create a margin in your page for observations. This is helpful to show critical quality attributes have been attained at each step of the procedure. However, the same can be attained if you choose to use the left page for observations and the right for the rest of your experiment information.

9. Software used. These can include software programs for equipment used or for data analysis, etc.
10. Analysis. Your final results for your experiment!