Here are some general tips for writing notebooks and lab reports.

REPORTS VS NOTEBOOK

In this class you may experience some uncertainty about the distinction between the content of your laboratory notebook, and your laboratory reports. The reports are modeled (sometimes loosely) on the form of a manuscript for publication in a scientific journal. Scientists do not ordinarily submit their notebooks for publication. Another general distinction is that most of the writing in the notebook can be done in the lab. Reports can be written anywhere.

For some exercises the written assignment will be your notebook entries; in others it will be a separate lab report. However, the quality of your reports will depend on the strength of your notebook records. I will try to address this issue directly and specifically for each experiment, but I fully expect that you will need to question me periodically to clarify exactly what should be in, or left out of, the reports.

Below there are general directions and hints for writing lab reports:

INTRODUCTIONS

In a real experiment of the ideal sort, the goal is to test a hypothesis. The hypothesis is explicitly stated in the introduction. In order for the reader to appreciate the relevance of the hypothesis you must provide some background information. Frequently students confuse a general hypothesis with a specific prediction. Hypotheses should be stated in general terms. Stated too specifically, a hypothesis degenerates into a prediction.

Don't use the need for background information as carte blanche to launch into a stream of consciousness discourse on all the cool and groovy things you know about biology. Get to the point quickly.

For example: "Proofreading by DNA Polymerase III lowers the frequency of spontaneous mutation."

This is a general statement that should be of interest to all biologists.

Compared to: "The E.coli strain which carries a mutation in the ε subunit of DNA polymerase III will have a higher frequency of spontaneous rifampcin-resistant mutants."

This is a prediction made by the general hypothesis within the context of a specific experimental system. As a hypothesis, this would interest a very narrow audience.

You can also describe the experimental system you plan to use in testing the hypothesis, but this goes after you have presented the hypothesis.

MATERIALS AND METHODS

In general, this part of the report has been provided to you in the handout. There is little to be gained by writing it over again.
In most of your reports this section will be limited to:

1) Tables or flow charts created before lab as a more accessible format that you can use at the bench.

2) Alterations of the procedure by accident (bloopers) or design.

RESULTS

Results tend to come raw. You cook them before writing the report.

For example: Many experimental results are collected in the form of a table. Time in column A, temperature in column B, and so forth. Numeric values are entered into the table in lab, in your notebook. This is the raw result.

Later, the information in the table may be reformatted as a graph, plotting time on the X axis and temperature on the Y axis. In a real scientific article, only the graph would appear. So the table of numbers would be in your notebook, and the graph would be in a written report.

Raw data is recorded in the lab notebook:

<table>
<thead>
<tr>
<th>elapsed time (min)</th>
<th>temperature °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>1</td>
<td>30</td>
</tr>
<tr>
<td>2</td>
<td>35</td>
</tr>
<tr>
<td>3</td>
<td>40</td>
</tr>
<tr>
<td>4</td>
<td>45</td>
</tr>
<tr>
<td>5</td>
<td>50</td>
</tr>
<tr>
<td>6</td>
<td>60</td>
</tr>
<tr>
<td>7</td>
<td>70</td>
</tr>
<tr>
<td>8</td>
<td>85</td>
</tr>
<tr>
<td>9</td>
<td>100</td>
</tr>
<tr>
<td>10</td>
<td>120</td>
</tr>
</tbody>
</table>

Only the graph is in the report:

![Temperature Graph](image)

NOTE: The graph above is NOT correctly formatted! Do not fall into the trap of copying default graphs directly from Excel to your lab reports without first properly formatting them.

DISCUSSIONS

The discussion is the most challenging and time-consuming part of the report to write. The most common failing is to simply restate the results in text format without discussing what they mean.

You must discuss the results in terms of the hypothesis and the prediction in the introduction, if any. Do the results support the hypothesis or not?
Expanding the discussion beyond the obvious conclusion, without descending into irrelevant
generalities is an art form.

Directions you can go are: Why should we care about this experiment? Does it shed light on basic
scientific problems? Does it have practical applications? What further work would be helpful or
interesting?

I often think that students sometimes mess up their experiments so that they will have something
to write in their discussions. Unexpected results or observations may or may not be meaningful.

It is meaningless to attribute an unexpected result to "experimental error" and leave it at that.
You must examine the source/es of the errors and describe ways to confirm those sources by
subsequent work.

"The results were wrong probably because of pipetting error. Next time we should be more
careful pipetting." This, by itself, is a very weak sort of error analysis, as it only raises the
question "Why weren't you careful the first time?"