PH211/212/213 Lab

General Information

There are three types of Investigative Science Learning Environment (ISLE) labs: observation experiments, testing experiments, and application experiments.

Observation experiments are intended to help learn skills such as changing one variable at a time, recording and representing observations, and making accurate observations without mixing them with explanations. This is the first step of the experimental cycle, and allows one to observe phenomena, look for patterns in data, and start to devise explanations once observations are carefully completed.

The next step, once explanations have been devised, is to perform testing experiments, which are designed to test hypotheses based on specific explanations and/or rules. This helps practice making predictions about the outcome of an experiment. For a testing experiment, one can’t just perform the experiment and record what happens. There must be predicted outcomes based on explanations. If the outcome of the experiment agrees with the prediction, then it gives confidence that the explanation may be correct, but if it disagrees, then one knows the explanation is incorrect. In order to make this judgment, one also needs to apply basic uncertainty calculations. A guide for determining uncertainty is included in these documents.

The third type of experiment is the application experiment, where some explanation and/or rule, which has been tested enough that one has confidence that it is correct, is applied to understand a new situation. Some application experiments require determining some unknown quantity multiple ways in order to determine if the methods are consistent. Again, it is necessary to apply basic uncertainty analysis.

By performing these sequences of experiments, it is possible to explore and devise physical relationships, test them, and when convinced that they are correct, apply them to understand new situations. By designing experiments, one acquires creative control, and assures that one understands the steps that are performed, as they are done by choice, and not by following instructions or by trial-and-error.

Lab write-ups:

Each group submits one lab report per lab. Each group member must put his or her name and student ID at the top of the report to earn credit. Since the ISLE labs are designed, and are intended to help learn specific skills such as justifying conclusions, comparing results, and understanding how uncertainty comes into play, it is important to explain carefully. The lab report is written during lab. The report is not formal, but it does need to be clear. There may be specific questions to be answered, or specific statements of tasks to complete. The lab instructions include bullet points that always need to be addressed in the report. The bullet points are specific to the type of experiment: observation, testing, or application.
The lab reports shouldn't be too lengthy or wordy. They can include complete mathematical equations, complete sentences, bullet points, and/or diagrams. The required bullet points should be addressed succinctly and clearly. Keeping the reports relatively short is good practice for science writing and will save valuable time. It will also help the reader to more easily see the main points.

**Lab grade:**

100 points are earned for attending and conducting all of the labs, and obtaining an average of at least two-thirds of the possible points for the lab reports over the course of the term. Each student must pass lab in order to pass the course. There is opportunity to make-up one or two labs during dead week.

**Grading:**

The lab TAs will grade the lab reports based on a subset of the required items. Each item will be graded as follows. No points are awarded if the item is not included in the report. One point is awarded if the item is included, but incompletely, or incorrectly. Two points are awarded if the item is included, but with some small mistake, or it isn’t completely explained. Three points are awarded if the item is correct and complete. Roughly five to nine items will be chosen for grading each week. For the items which are specific to the three types of ISLE experiments (observation, testing, and application), there is a set of rubrics used to evaluate the reports. After writing the lab reports, check them with the rubrics before submitting them.

**Rubrics:**

The observation, testing, and application Lab Grading Rubrics specific to ISLE experiments are included in these documents. Bring a paper copy of these to lab and use them for self-evaluation while writing the lab reports. They are not just used for grading, but are also intended to help understand the skills to be developed and demonstrated, and assess and improve the quality of the reports.

**Other information:**

Lab is not for testing knowledge, but for developing it. Take advantage of the time to explore the physical relationships, make sure things make sense, and use the TAs as resources.

In order to be counted as present for the lab, you must arrive on time and stay until the lab report is submitted. During the first and the last lab, assessments may be given. These assessments must be completed in order to be counted as present for the lab, but they do not count toward the course grade. The responses are used only to assess how much students learned during the course.