

## EXPERIMENTAL PROPOSALS

### BACKGROUND

The experimental proposal serves as the basis for the design and execution of an experiment as well as the lab report. Therefore, it should contain all the relevant information concerning the preparation and execution of an experiment. To produce a successful and reproducible experimental study, it is essential that an accurate log be maintained. Normally, a log is kept in a bound book in which no pages should be removed. However, for instructional experiments, loose-leaf pages and computer-generated spreadsheets to record data are generally utilized in place of a logbook. All pertinent experimental data needs to be recorded. This includes everything that might influence the outcome of the experiment, such as when and where the experiment was performed, instruments used, environmental conditions, any anomalies noted, etc.

### PREPARATION AND PLANNING

One important aspect often neglected in laboratory work is that of preparation and planning. An experiment cannot be executed properly if the theory and general expected results are not understood. Before performing an experiment, an experimental proposal should contain, but not necessarily be limited to, the following items:

- *Statement of Purpose.* Indicate the purpose of the experiment, i.e. what principle or hypothesis is being tested, what pattern is being sought.
- *Derivations of Required Relationships.* These include all the relationships that are required to complete the experiment that are not already derived in a previous work. If a prior derivation is used, it must be adequately referenced. The propagation of error analysis could also be initiated here.
- *Suggested Experimental Procedure.* This will be a plan for the conduction of the experiment. Any deviations from the planned procedure should be noted during the experiment and justified in the report on the experiment. Note: enough details should be presented here that any researcher would be able to follow the suggested procedure and obtain comparable results.
- *A Computer-Generated Spreadsheet for the Recording of all Pertinent Data.* The spreadsheet should contain the required analysis of the data. A dummy data set should be used to test the analysis. By doing this before performing the experiment, considerable time may be saved in performing the experiment and data reduction, plus unexpected experimental problems and errors may be identified and corrected while performing the experiment.

Modified parts of the experimental proposal will constitute segments of the subsequent laboratory report (see the references on Memo and Long Laboratory Report Formats).

## PERFORMANCE AND RECORDING OF THE EXPERIMENT

A record of what occurs in the experimental phase should be kept. It should be neat enough to actually be useful in finding errors in recordings and calculations. Recordings should be in ink. This portion may include several or all of the following items:

- Recorded information taken directly from the experiment placed onto the spreadsheets.
- Experimental observations that may be useful in interpretation of the recorded data.
- Changes in procedure, due to faulty equipment, or the like.
- Test plots (hand done), to check that the data is generally correct.
- Sample calculations to also ensure the data are generally correct.
- Details of the apparatus and instrumentation that will be useful in understanding the calculations and writing the report. This *must* include apparatus, sample and instrument identification numbers, manufacturer, model or type, and serial number, and measurement accuracy when available.

Experience has shown that the following errors are often made while performing experiments:

- Neglect to record ambient conditions.
- Neglect to record units on the various readings.
- Neglect to record data on the different instruments.
- Neglect to record changes in the experimental procedure.
- Neglect to note problems with the experiment.

## EXPERIMENTAL PROPOSAL CHECKLIST

The following is a typical experimental proposals checklist that may be combined with a checklist for a memo report. The actual weightings of the different sections may differ depending on the particular experiment.

### EXPERIMENTAL PROPOSAL CHECKLIST

- **Statement of Purpose (10%)** *Does this section place the experiment within a context and give a concise statement of the principal or hypothesis to be tested?*
- **Derivations of Required Relationships (30%)** *Does this section give an adequate development of the pertinent equations, coefficients, and theoretical relations?*
- **Experimental Procedure (30%)** *Does this section give the reader a good visual sense of the testing procedure that is proposed including data analysis and error estimation? Could another experimenter duplicate the experiment and achieve comparable results?*
- **References (10%)** *Are all pertinent references included?*
- **Spreadsheet (20%)** *Is this a comprehensive and well-organized spreadsheet or is it missing major components?*
- **Grade (100%)**
- **NOTE:** These sections may be combined with either a Memo or Long Report Format checklist as an entire document. In such a case the percentages must be adjusted to reflect the fact that the experimental proposal is part of the whole.