



Introduction to the U of T Physics Practicals

The Physics Practicals are a vital aid in your learning of Physics. We have devised a number of Activities and Projects which will help you to learn a lot of Physics. They will also help you to do well on the tests and exams of your course. We are very excited about this new way of helping you to learn Physics, and hope you find your time in the Practicals to be fun and productive.

Web Site

All documents and datasets are available at the following web site:

<http://faraday.physics.utoronto.ca/Practicals/>

As discussed below, required materials, documents, and programs are also available on the Practical server `Feynman.physics.utoronto.ca`.

How the Practicals Work

The Practicals meet for one hour 50 minutes every week.

The heart of your learning in the Practicals is going through a series of Activities. Most of the Activities are closely related to what is currently being discussed in class, although sometimes they will extend that material or occasionally introduce other topics which we feel are important for you to know about. Each Practical session will also include time for student questions and discussion.

You will be working with up to three of your classmates in a Team. You will have two *Learning Assistants*¹ present for each Practical session.

Your Team will keep a *single* lab book, which is to be a complete record of everything you did, what you and your teammates thought it meant, and what conclusions you have drawn from your work. The lab book is not to leave the Practical room.

For each Practical session two members of each Team will serve the following roles:

- **Facilitator.** This person, a different individual each week, is responsible for keeping the Team on track with the Activities. When the entire Practical group discusses some topic, the Facilitator will be the Team's primary spokesperson.

¹ Some other courses call these people *Teaching Assistants*.

- Recorder. This person, also a different individual each week, takes primary responsibility for recording all work, speculations, conclusions etc. in the lab notebook.
- Skeptic. This person's job is to be skeptical of all answers to the questions and conclusions for each activity. Note that "skeptic" is not just being critical or negative: a skeptic is inclined to question or double all accepted opinions.

Evaluation

Your mark in the Practical will be based on evaluation of work that you do with your Team and work that you do individually. The evaluation of work done with your Team, all members of the Team will receive the same mark.

All marks are on a 5 point scale from 0 to 4:

0. Missing work.
1. Seriously deficient.
2. Requires improvement.
3. The standard mark indicating good work
4. Exceptional. We will be very stingy in awarding marks of 4.

Each mark component has a *weight*, and the mark times the weight will be added to generate a Practical mark out of 100. The total number of weights of all components is 25. Thus the Practicals are marked out of 100.

Attendance at the Practicals is vital for your learning. If you do not attend, you will also let down the other members of your Team. We will deduct the *cube* of the number of unexcused absences from the final Practical mark. Here "absences" also means showing up more than a few minutes late or leaving more than a few minutes early.

Twice each term the Learning Assistants will collect the lab books for marking. A random selection of Activities will be chosen for marking. All Teams will have the same Activities marked.

For each Practical session, we will provide a list of Activities. Some Teams work faster than others, so we will usually have one Activity designated as **If You Have Time** (IYHT). In general, quality is more important than quantity, so doing a careful job on the required Activities is of more benefit than rushing to complete all required Activities and the IYHT one. One of the IYHT Activities will be chosen, and if your Team has worked on it and it looks reasonable a bonus of $\frac{1}{2}$ of a mark will be awarded.

Turnitin.com

One of our responsibilities is to protect you from any classmates who may be tempted to submit work that is not their own. Therefore students agree that by participating in the Practicals, all required papers may be subject to submission for textual similarity review

to Turnitin.com for the detection of plagiarism. All submitted papers will be included as source documents in the Turnitin.com reference database solely for the purpose of detecting plagiarism of such papers. The terms that apply to the University's use of the Turnitin.com service are described on the Turnitin.com web site.

Computers and Networks

The Practical server is: feynman.physics.utoronto.ca.² You will access the server using your UTORid and password. You will have access to three folders on this server:

1. Your home directory. You have read and write privileges for this directory.
2. Your team directory. All members of your team have read and write privileges here.
3. public. This is an area of the server containing documents, computer programs, etc. Everyone has read privileges for this directory.

Note: you should never save work on the local PC. These discs will be ruthlessly purged on a regular basis.

Remote Access

You may access the server at: <https://feynman.physics.utoronto.ca>. You may upload and download files from your computer to the server.

Printing

There is a colour printer in each Practical Room. You may choose to print either in colour or black and white by choosing the appropriate printer in the print dialog. We charge for printing using your **TCard**. We charge:

- 10 cents per page for black and white printing.
- 15 cents per page of colour printing.

We do not (yet) have facilities in the building to add dollar values to your card. The locations of cash-to-card locations is at:

<http://content.library.utoronto.ca/finance-admin/photo/cash-to-card>

At present the nearest location is the Main Floor of the Earth Science building, just across Huron Street.

Datasets

² Richard Feynman was one of the giants in the development of Quantum Mechanics.

All datasets in the Practicals have a standard uniform format. This section describes that format.

The dataset file is text.

- 1 The first line of the file is the title of the dataset.
- 2 The second line of the file names the variables of the data. The names are separated by tabs. In the examples below we represent a tab with: <TAB>
- 3 The third and subsequent lines of the file contain the data. Each datapoint is on a separate line and the values are separated by tabs.

Thus, the dataset can be edited with a text editor or a spreadsheet program such as *Excel*. There are four cases for the number of variables in the dataset.

One Variable

If only one value is given for each datapoint, it is the dependent (i.e. y) variable. In this case the values of the independent (x) variable are assumed to be 1, 2, 3, ... in order.

Here is an example of such a dataset:

```
Balonium decay values
Counts per second
50
32
27
15
11
8
```

Two Variables

In this case the first column contains the values for the independent (x) variable and the second column the values for the dependent (y) variables. For example:

```
Student collected data on pressure-temperature values
Pressure (cm Hg)<TAB>Temperature (C)
65<TAB>-10
75<TAB>17
86<TAB>42
```

In the above <TAB> denotes the TAB character.

Three Variables

If there are three variables, the third one is the error in the dependent (y) variable.

```

Thermocouple calibration data
Temp (C)<TAB>Voltage (Volts)<TAB>errV
0<TAB>-0.89<TAB>0.05
5<TAB>-0.69<TAB>0.05
10<TAB>-0.53<TAB>0.05

```

Four Variables

Now there are explicit errors in both coordinates of the data. The first column contains the name and values of the independent (x) variable, the second column contains the name and values of the error in the independent variable, the third column contains the name and values of the dependent (y) variable and the fourth column the name and values of the error in the dependent variable.

```

Pearson's Data with York's Weights
X<TAB>errX<TAB>Y<TAB>errY
0<TAB>0.0316<TAB>5.9<TAB>1
0.9<TAB>0.0316<TAB>5.4<TAB>0.746
1.8<TAB>0.0447<TAB>4.4<TAB>0.5

```

This Introduction was written by David M. Harrison, Dept. of Physics, Univ. of Toronto in December 2007.

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