



## PHY131 Practicals Day 1 Student Guide

Summer 2009

Welcome to the Physics Practicals! 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 exam of the 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.

### ***How the Practicals Work***

You will be meeting for 2 hours every Tuesday and Thursday in room MP125A, B or C. Each *Group* will have a maximum of 36 students. You will be working in a *Team* with up to three of your classmates. There will be two Teaching Assistant Instructors present for each Practical.

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.

Each Practical session will include time for student questions and discussion. However the “heart” of the Practicals will be a series of Activities.

Every week you will be doing Activities based on the material currently being discussed in class. Often the Activities will be based on material that has already been discussed in class, but sometimes the Activities may be used to introduce material that has not yet been talking about in class.

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.

**Recorder:** This person, also a different individual each week, takes primary responsibility for recording all work, speculations, conclusions etc. in the lab notebook.

### ***Evaluation and Marks***

The Practicals will count for 20% of your mark in PHY131.

All marks will be given on an integer scale from 0 to 4:

0. Missing work.
1. Seriously deficient.
2. Requires improvement.
3. The standard mark indicating good work which meets all expectations.
4. Exceptional. Work which goes well beyond the expectations in the write-up.

Here are the components and their weights:

1. **Notebook Mark 1 (0 Weights)**. After the first Practical the lab books will be collected and marked. However, this mark will not count towards your Practical mark. Instead it is intended to make our standards and requirements clear to you.
  2. **Error Analysis Assignment (1 Weight)**. You will do this assignment individually. This is the only part of the practicals not marked on the integer 4-point scale; it is marked out of 100.
  3. **Scientific Method Module (1 Weight)**. This Module will be done during the second practical, and will be marked.
  4. **Notebook Mark 2 (6 Weights)**. After the last Practical before Test, a selection of Activities from Practical sessions completed so far will be chosen to be marked. The decision of which Activities will be marked will be chosen more-or-less randomly after the books have been collected. All Teams will have the same Activities marked.
  5. **Numerical Approximation Module (1 Weight)**.
  6. **Notebook Mark 3 (6 Weights)**. At the end of the term a selection of the Mechanics, Oscillations and Fluids Activities you have done since the Test will be chosen to be marked. The decision of which Activities will be marked will be chosen more or less randomly after the books have been collected. All Teams will have the same Activities marked.
  7. **Individual Assessment (5 weights)**. Throughout the semester your two TAs will be observing how you, as an individual, perform in the practicals on an ongoing basis. In arriving at this mark, your TAs will take into account your preparedness, the way you approach and organize experimentation and record-keeping, and your ability to work effectively with your team members. Also considered will be your ability to estimate errors (rather than calculating each one exactly), your ability to distinguish the essential from the inessential, your willingness to try something, to make a mistake, and to learn from it, and how often you seek advice and ask questions. If an individual is often late or absent this may also affect the Individual Assessment mark. At the end of the course, the in-lab mark will first be computed on the integer 4-point scale by both of your TAs independently. Then, in consultation with the practicals coordinator, half-integer marks will be allowed as the results from both TAs are combined into a single mark for each student. Therefore, the Individual Assessment mark can have a value of 0, 0.5, 1, 1.5, 2, 2.5, 3, 3.5 or 4. As usual, 3.0 is the “standard mark” which, by course policy, most students will receive.
- All teams should stay for the entire 110 minutes during each week of Practicals. If a student arrives more than 20 minutes late (ie later than 30 minutes past the hour), then he or she is counted as absent for that day. If a student leaves more than 10 minutes early, he or she is counted as absent for that day.
  - *Cube of Absences Rule*: Attendance at the Practical is vital for your learning. If you do not attend, you will be letting down your team-mates. The Practicals mark (worth 20% of the course mark) will be converted to a mark out of 100. The number of

absences each student has will be cubed and deducted from this total out of 100. Effectively, this means that one absence generates a 1% penalty in Practicals mark. Two absences generates an 8% penalty. Three absences generates a 27% penalty, etc.

- *If You Have Time Activities (IYHT)*: IYHT Activities should not be attempted by any teams until they have spoken to a TA and obtained permission. For each Notebook Mark which counts, one IYHT activity will be randomly selected along with the regular activities. Teams that did well on the chosen IYHT get a 0.5-point bonus, while teams that didn't do it or tried but didn't do well on it get no bonus points.

## **Computers and Networks**

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

Your home directory. You have read and write privileges for this directory.

Your team directory. All members of your team have read and write privileges here. 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 the 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.

## **Error Analysis Assignment**

You may access this assignment at:

<https://www.upscale.utoronto.ca/PVB/Harrison/ErrorAnalysis/index.html>

This is a series of online tutorials which must be viewed with a computer. PHY131 students must read through and perform the activities in these tutorials, and write the answers on a paper print-out of the 3-page "Answer Sheet", which is linked as a PDF on the first page of the assignment.

The answers, done by individual students, are due in the 3rd practicals session.

## **Concepts of this week's Module**

- Scaling
- Motion Diagrams



### **Course Concepts**

#### ***Mechanics Module 1, Activity 1***

A sculptor is making a statue of a duck. She first creates a model. To make the model requires exactly 2 kg of bronze. The final statue will be 5 times the size of the model in all three dimensions. How much bronze, in kg, will she require to cast the final statue?

You may find it helpful to think about the model being constructed of Lego blocks, with the final statue made of Lego blocks that are 5 times the size in each dimension as the ones used to make the model.



### **Course Concepts**

#### ***Mechanics Module 1, Activity 2***

When the sculptor finished making her model of the duck statue, she gave it 2 coats of varnish. This took exactly one can of varnish. How many cans of varnish will she need to give the final statue 2 coats of varnish?



### **Course Concepts**

#### ***Mechanics Module 1, Activity 4***

The ancient Greeks built a temple to Apollo on the island of Delos. It was 11 m wide, 24 m long, and 10 m high. In 427 B.C. a plague ravaged Athens, and the Athenians consulted the oracle on Delos, who demanded that they double the size of the temple.

- What is the original volume of the temple?
- The Athenians re-built the temple by doubling the size of each dimension of the temple. What was the volume of the new temple?
- The Athenians consulted to oracle again, who said “You have not doubled the size of god’s temple, as he demanded of you.” What mistake did the Athenians make?
- What would be the dimensions of the temple that the oracle wanted the Greeks to build?



Here are some made up data for the x component of the position of an object at various times:

Time (s)	Position (m)
0.00	0.002
0.10	0.111
0.20	0.385
0.30	0.892
0.40	1.613
0.50	2.501
0.60	3.612

- A. Sketch a graph of position vs. time. . Make the horizontal axis the time and the vertical axis the position.
- B. Is it reasonable to “connect the dots” with a smooth line in the graph you sketched? If yes, what assumption is being made about the motion of the object? If no, why?
- C. Sketch a motion diagram of the motion of the object.
- D. Calculate the displacements of the object for each 0.1 s interval.
- E. How does the number of displacements you calculated compare to the number to the number of data points in the position-time data?
- F. From Part D, calculate the x components of the average velocities of the object for each 0.1 s interval.
- G. Consider the first of the average velocity values from Part F. At what time does the object have this value of the average speed? Is the value of the time a single value or a range of values? Why?
- H. Sketch a graph of the average velocity versus time. Make the time the horizontal axis.
- I. From your result from Part F calculate the x component of the average acceleration of the object for each 0.1 s interval. How does the number of calculated values of the average acceleration compare t the number of data points in the position-time data?
- J. Sketch a graph of the average acceleration versus time. Make the time the horizontal axis.
- K. What does the data indicate about the acceleration of the object?


**Course  
Concepts**
***If you have time: Mechanics Module 1, Activity  
11***

[**STOP!** Please go back and take a second look at what you have recorded in your notebook for the mandatory activities. Is there anything missing? Can anything be improved? Does your TA have advice on what you might be able to do better? Please do not attempt this “If you have time” activity until you feel confident that the other activities are completed to the best of your ability, and you have obtained permission from one of your TAs.]

A Cart Launcher is mounted on one end of the Track. Raise the other end of the Track by raising the feet 3.000 cm. The Launcher may be cocked by pulling back the horizontal rod until the disc mounted on it latches to the “finger” on the base. Cock the Launcher and place the Cart against it. Fire the launcher.

You want the Cart to travel almost but not quite all the way up the Track. You want the highest position to be at least a few cm away from the magnetic bumper mounted on the far end of the Track, so the cart does not interact with the bumper. You may need to adjust the Launcher to achieve this. There is a disc mounted on the rod that pushes the Cart whose position can be adjusted to get the desired force.

- A. Sketch a motion diagram of the movement of the Cart up the Track from a moment after it leaves the launcher until it comes to rest. It should have some resemblance to one of the motion diagrams of Activity 6.
- B. Roughly, what is the time between each successive dot of Part A?

Remember that best laboratory practice is to record *everything*. The Launcher includes a scale that reads how far the spring has been compressed when it is cocked. You should record this value.

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This Mechanics Module Guide was written in May, 2007 by David M. Harrison, Dept. of Physics, Univ. of Toronto.