

# PHYSICS 204

Physics for Scientists and Engineers I

Lab Manual



Plant's height  $y$  (cm)

42.0  
41.5  
41.0  
40.5  
40.0  
39.5

0.5 1.0 1.5 2.0 2.5

time elapsed  $x$  (day)

## PHYS 204 Home Lab Manual

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The manual was extensively revised by Dr. Farook Al-Shamali in 2004 (v.2.1) and then further improved in 2008 (v.2.2). This PHYS 204 Lab Manual is a revised version of the PHYS 200 (v.2.2) Lab Guide.

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## Introduction

The lab component provides a hands-on experience of the physical concepts covered in the course, using suitable tools and equipment. The lab experiments are meant to go with the course material, so you can connect theory and physical phenomena. All the experiments in the manual will be done in a place of your choice.



### *Lab Kit*

The material required to perform the lab experiments in this manual are to be borrowed from the Athabasca University Library in the form of a lab kit. This includes instruments and devices (see picture above) that are necessary for performing the experiments. Each kit contains:

1. Go! Motion sensor unit
2. USB cable
3. pulley
4. pulley axle
5. pulley support jig
6. fold-back paper clips
7. hockey puck
8. digital stopwatch
9. 100 g brass masses

The lab kit will be mailed to you shortly after you request it. Sometimes you will be placed on a waiting list if the demand for the kits is high. When you receive the kit, it will contain a card for return postage. Note that this is similar to the book borrowing procedure, which you are also encouraged to use.

To reach the library, call the toll-free number 1-800-788-9041, ext. 6254. You can also browse the library website at <http://library.athabascau.ca>. In addition to your student number and a shipping address, you will have to clearly indicate to the library staff which course you are enrolled in. Note that only those enrolled in an Athabasca University physics course may borrow lab kits.

**Note:** Experiments 1, 2, and 7 can be completed without the lab kit.

## *Computer and Software*

To perform the lab experiments in this manual, you will need to have a computer with a USB port. The computer will be used for the collection and analysis of experimental data, and for the preparation of the lab reports. You will also need **Logger Pro** software from Vernier Software & Technology ([www.vernier.com](http://www.vernier.com)). This is an interface program that allows you to monitor the motion sensor measurements and save them on your computer. The program is also needed for data analysis. Logger Pro is available for download from the course website.

## *Evaluation*

You are expected to perform seven experiments according to the guidelines presented in this manual, and you will prepare a lab report for each experiment. All reports

should be submitted to your tutor for assessment. The lab component counts for 20% of the total course mark, and will be divided among the seven experiments as follows:

Experiment 1	2%
Experiment 2	3%
Experiment 3	3%
Experiment 4	3%
Experiment 5	3%
Experiment 6	3%
Experiment 7	3%

It is important to accumulate a total lab average of at least 50% to pass the course. If you have lab credit from another institution, you may wish to inquire about transfer of lab credit. Such transfer and any evaluation associated with it are entirely at the discretion of Athabasca University. You will be required to submit original lab materials, done by you, for evaluation toward potential transfer of credit. You must discuss this possibility with the course coordinator before submitting any such materials.

## ***Lab Report***

Lab reports are an effective way of communicating important information, and their use is stressed in this course. There is little point in doing a wonderful experiment with great results if you cannot effectively communicate your findings to others. Sometimes, the results will not seem so great, and organizing yourself to write the report will help to understand what went wrong. On the other hand, the results we are seeking are relatively straightforward, so there is no need to make the report overly long!

The lab report serves several purposes and gives an organized framework for recording your procedures and results. Although some students may have encountered laboratory reports before and may feel that there is a standard format for them, this is not entirely true. However, make sure to include the following sections:

1. **Cover Page:** On this page you write the course's name and number, lab manual version, experiment's title, your name, student ID, and date completed.
2. **Introduction:** (10%) Here, provide your theoretical background including all formulas needed in the analysis.

3. **Procedure:** (10%) Here you should give a clear and detailed description of your steps in performing the experiment. If there is more than one part to the lab, it is usually best to describe the actions and observations separately for each part.
4. **Pictures:** (10%) Include clear pictures of your setup.
5. **Data:** (10%) Organize and present the data collected in the experiment, and provide a description of the trend and behaviour of the collected data. No calculations or analysis should be included in this section of the report.
6. **Analysis and Discussion:** (40%) This is a very important section of the lab report. In here you are expected to give a clear and detailed analysis of your data, as described in the manual. Make sure to include sample calculations, especially for new calculated columns in data tables. You may also need to produce graphs and perform appropriate fits using the Logger Pro software. Errors in the observations may have a bearing on your analysis and you should discuss their role here.
7. **Conclusion:** (10%) Present a brief summary of your findings in this experiment, including the final numerical results.
8. **Questions:** (10%) At the end of each lab you will find a number of questions related to the experiment. Provide a detailed answer to these questions at the end of the lab report.

## ***Lab Safety***

Appropriate care should be taken due to moving objects and other potentially hazardous situations and materials. The level of risk involved in doing these labs is comparable to that of day-to-day activities and care has been taken to avoid suggesting activities which produce hazards.

It is your decision to proceed with any experiment, and in making that decision you control your own situation and assume any risks involved. It is your responsibility to act in a responsible manner to avoid hazard to yourself or members of the public.

The authors, Athabasca University, or any equipment supplier cannot be held liable for the consequences of any action undertaken in association with these laboratory exercises. If you cannot safely do these labs, please withdraw from the course.