

Lab 11: Your own scientific investigation

LEARNING GOALS OF THIS LAB:

1. Learn to formulate an interesting scientific investigation
 2. Learn to design experiments that will be productive in achieving the goals of the investigation.
 3. Learn to identify opportunities for further scientific investigations.
-

PRE-LAB (Start this the same day you do lab 10)

In this course you have been learning physics through the process of scientific discovery, much the same way professional physicists do. But, there is one part of this process you have not experienced: Deciding what to investigate. Each experiment you have done in lab this semester began with a scientific question such as “test the idea that an object always moves in the direction of the net force exerted on it” or “determine the coefficient of static friction between your shoe and this floor tile”. In other words, you were given the scientific question, and then you designed an experiment to answer it.

In Lab 11 you will come up with your own quantitative scientific investigation, then design experiments to carry it out. The equipment you will have available is listed below in Part I. The equipment will be on display in a cart in the lab room for you to examine in advance, both during lab 10 and during your recitation the following week. Here’s what you need to do before coming to lab 11:

- a) Think carefully about the scientific process we have used in this course (particularly in lab) to build our understanding of physics. Think about the role of each of the three types of experiments (observation, testing, application) and how these types of experiments fit into the scientific process. Review the “Science Strategy” document on the course website.
 - b) Examine the available equipment carefully. Begin thinking about what scientific investigation you can carry out using this equipment.
 - c) Discuss your possible investigations with your lab group members. Which do you find most interesting? Which do you think have the most value in being carried out?
 - d) Which investigations sound the most promising and have the highest likelihood of being successful?
 - e) Once you have narrowed down the list of investigations, send an email to your lab TA and to Mike or talk with them directly. Explain to them the investigations you are considering. They will then give you feedback. It is very important that you contact Mike as well so he can make sure there is enough equipment for you to carry out the investigations you are planning.
-

I. FORMULATE YOUR SCIENTIFIC INVESTIGATION

Available equipment: Equipment shown in pictures at end of lab. Plus: Calorimeter, stopwatch, meter stick, ring stand, clamp, balance, computer with Logger Pro and Microsoft Excel. *You can also bring additional equipment of your own. But, if you are going to do this be sure to contact your TA in advance and check with them.*

- a) Come to a consensus with your group members about which scientific investigation you will carry out. Write it down as clearly and specifically as you can.
- b) Call your TA over and discuss your investigation with them.

II. DESIGN AND PERFORM AN EXPERIMENT TO BEGIN YOUR INVESTIGATION

- a) Determine which of the three kinds of experiment you will need to do to begin your investigation. Explain how you know which of the three it is.
- b) Use the rubrics on the course website to remind yourself of what you need to do to perform a successful experiment of that kind.
- c) Design and perform the experiment. Remember, it must be quantitative. Record your experimental design, your data, and your results: include sketches, graphs, tables, diagrams, whatever representations you need.
- d) Make sure you have included all important elements of an experiment of the kind you are doing. Double-check using the appropriate rubrics. Once you have done so, move on to the next part.

III. CONTINUING YOUR INVESTIGATION

- a) The process of science is a continuous cycle. Now that you have completed an experiment to start the cycle you are ready to move on to the next step. What is the next step? Which type of experiment is it?
- b) Design and perform an experiment that continues your investigation. Use the appropriate rubrics to make sure you have included all the appropriate elements in your experiment.

IV. WHY DID WE DO THIS LAB?

1. Did your experiments turn out to be productive in carrying out your scientific investigation? If so, explain why it was productive. If not, explain why it wasn't. In either case, describe what you could do to improve your investigation.
 2. Often in the process of an investigation opportunities for new investigations arise. Describe a few of the opportunities for new investigations that you thought of while you were performing your experiments.
 3. What did you find most challenging about this week's lab activity?
-

APPENDIX. AVAILABLE EQUIPMENT









