



SelfGuide

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PreLab: questions to answer before doing the lab

First, carefully read the description of the lab:

In most lab classes, you will have a lab manual that contains background for the lab and directions for doing the lab procedure. There may also be handouts or other materials you have access to. Read it all. And don't just skim it. In fact, you may need to read it more than once to get a good grasp of it.

Next, answer the following questions about the lab:

1. What scientific concept(s) is this lab about?

Identify the scientific concept(s) (principle, theory, law) of the lab and write what you know about the concept(s) from the lab manual, textbook, class notes, handouts, etc.

Most science labs are designed to help you learn about a scientific concept. If you are having trouble identifying the scientific concept this lab is about, check the title of the lab in the lab manual and read the introduction to the lab in the manual. It will be something like photosynthesis, chemical reactions, or inertia. Write down the scientific concept.

Then write down what you know about the concept based on the lab manual, textbook, class notes, and handouts. Don't try to make it pretty; just write it. Get as much down as you can. Because the point of the lab is to learn about the scientific concept, it's important to state what you already know about it.

2. What are the objectives for this lab?

Describe the specific actions you are being asked to perform in the lab, such as measure something, analyze something, test something, etc.

Objectives are the activities you are being asked to do in order to complete the lab experiment. Often the objectives are listed in the lab manual. You can list the objectives or write them in a paragraph. If they are not listed in the lab manual, read the lab procedure and figure out from the procedure what the objectives of the lab are. Because objectives are activities, be sure to list them as such: to measure, to analyze, to determine something.

3. What is the overall purpose of the lab?

Briefly describe how what you are being asked to do in the lab (the objectives) will help you learn about the lab's scientific concept(s). In other words, show the link between your response to question #2 (what you will do in the lab) to your response to question #1 (what you are supposed to be learning about by doing the lab).

The purpose of the lab is to learn something about the scientific concept the lab is about. This is where you make the all-important link between what you are doing and what you are learning. For example, if the scientific concept is photosynthesis, how will measuring respiration rates help you understand photosynthesis? This is

the kind of question you need to ask yourself. Read over the objectives again. They outline what you will be doing in the lab experiment. Describe how you think completing the lab will help you learn about the concept?

4. What is your hypothesis for the lab experiment?

First, identify the **variables** in the experiment. Then state your **hypothesis**--the relationship or interaction among the variables, the outcome of the experiment you anticipate. Your hypothesis may be stated in 1-2 sentences or sketched out as a graph. (See below for definitions of underlined terms.)

The variables are what you will manipulate (independent variable) and measure (dependent variable) in the lab procedure. The hypothesis is what you anticipate will be the outcome of the procedure, typically the results of the measurements of the dependent variables when the independent variable(s) is manipulated. So the hypothesis is what you expect, based on your understanding of the scientific concept of the lab--what the relationship among the variables will be.

Variables:

A **variable** is what is measured or manipulated in an experiment. Variables provide the means by which scientists structure their observations. Identifying the variables in an experiment provides a solid understanding of the experiment and what the key findings in the experiment are going to be.

To identify the variables, read the lab procedure described in the lab manual. Determine what you will be measuring and what you will be manipulating for each measurement. The value(s) you are manipulating is called the **independent variable** (see definition below) and the value(s) you are observing/recording is called the **dependent variable** (see definition below). Write down the dependent and independent variables. In more advanced labs, you may have **multiple variables** (see definition below), more than one independent and dependent variable.

Independent and Dependent Variables:

An **independent variable** is the variable you have control over, what you can choose and manipulate. It is usually what you think will affect the dependent variable. In some cases, you may not be able to manipulate the independent variable. It may be something that is already there and is fixed, something you would like to evaluate with respect to how it affects something else, the dependent variable like color, kind, time.

A **dependent variable** is what you measure in the experiment and what is affected during the experiment. The dependent variable responds to the independent variable. It is called dependent because it "depends" on the independent variable. In a scientific experiment, you cannot have a dependent variable without an independent variable.

Example 1: You are interested in how stress affects heart rate in humans. Your independent variable would be the stress and the dependent variable would be the heart rate. You can directly manipulate stress levels in your human subjects and measure how those stress levels change heart rate.

Multiple Variables:

It is possible to have experiments in which you have **multiple variables**. There may be more than one dependent variable and/or independent variable. This is especially true if you are conducting an experiment with multiple stages or sets of procedures. In these experiments, there may be more than one set of measurements with different variables.

Example 2: You are interested in finding out which color, type, and smell of flowers are preferred by butterflies for pollination. You randomly choose an area you know to be inhabited by butterflies and note all the species of flowers in that area. You want to measure pollination of flowers by butterflies, so your dependent variable is pollination by butterflies. The independent variables are flower color, type, and smell. You will need to specify relationships for each of these independent variables with the dependent variable.

Hypothesis:

A **hypothesis** is a scientist's best estimation, based on scientific knowledge and assumptions, of the results of an experiment. It usually describes the anticipated relationship among variables in an experiment. Since dependent variables "depend" on independent variables, there has to be a relationship between the two. The anticipated relationship between the dependent and independent variables is the result you expect when one variable reacts with another.

A hypothesis typically leads to the crucial questions that must be addressed in the lab report: did you find what you expected to find? why or why not? The point of an experiment is to test the hypothesis. Write or sketch your hypothesis, describing the relationship among the variables you listed.

5. What reasoning did you use to arrive at your hypothesis?

Explain your hypothesis using the scientific concept of this lab to show the reasoning behind your prediction.

Your hypothesis is a prediction of the outcome of the lab. This prediction is based on your understanding of the scientific concept of the lab. That understanding shapes your prediction of how the lab experiment will turn out, the relationship among variables that you anticipate. Write a paragraph or so describing the logic you used to go from your understanding of the scientific concept to formulating a prediction of the outcomes of the experimental procedure.



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