

## Welcome to the Virtual Lab

Discovery Education Science Connection's Virtual Labs give you real-life problems to solve in a "virtual lab" that you will find on your classroom computer. The problems require you to figure out some science. They also require you to *do* some science. In fact, the purpose of these labs is to help you learn to think and act like a scientist.

The Virtual Labs are interesting, challenging, and fun. In one lab, you figure out how to make a building "earthquake-proof." In another, you design a ball rolling game for a fair. Other labs let you investigate stars, bread recipes, lighting, rabbits—and many other topics. Your teacher will decide which labs you will do.

Most of your work is done in the Virtual Lab on the computer. Here you will find some equipment, instruments, information, and other resources that you can use to help solve your real-life problem. What happens in the Virtual Lab is up to you and your teacher. You must decide what questions to ask and how to design an experiment to answer them. You must collect data in a systematic way, usually using a data table, and you must figure out how to use the data to help solve the real-life problem.

You will probably work with one or more classmates in the Virtual Lab. Each small group will investigate its own question. When you are all done, all the groups will get together to share their data. Together you will look for the best solution to the real-life problem. Sometimes you'll find one solution, sometimes you'll find several. Occasionally, you won't be able to find any solution at all. That's OK. That's how science goes.

## How to Do a Virtual Lab

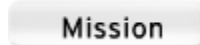
Each time you do a Virtual Lab, you will follow the same general procedure. Just click the tabs you see at the bottom of the screen of every Virtual Lab and follow the tabs in order, left to right.



The tabs look like this:



Every lab starts out with a real-life problem or puzzle that you have to solve. Click the **Intro** tab to read about it.



Click the **Mission** tab to learn what you have to do to solve the problem. This tab also links you to your Briefing Document, which gives all the information you need to complete your mission. Always read the Briefing Document for a Virtual Lab before entering the Explore Lab.

**Explore**

Click the **Explore** tab to enter the Explore Lab. Here you will learn how to work with the materials and simulators you will find in this Virtual Lab. You will try out the equipment, ask some questions, and conduct some simple investigations. As you explore, you will discover that the problem you are trying to solve involves certain variables, and that you can change those variables in the lab. The values you choose for these variables will affect the outcome of your mission.

The purpose of the Explore Lab is to become familiar with the problem, the variables, and the lab setup so that you can write an experiment plan. So you should spend

some time in the Explore Lab investigating the variables and thinking about how you can use the lab to solve the real-world problem. Take notes about what you learn because you will need that information later, when you go to the Experiment Lab. The Experiment Lab will be similar to the Explore Lab—for example, it will have similar equipment and materials—but sometimes there will be differences, especially in the number of variables you can investigate. Be sure to read the Briefing Document so that you will know about those differences before you write your experiment plan.

**What Are Variables?**

When you conduct your investigations in the Virtual Lab, you will be asked to change certain things and then see what happens as a result of your changes. The things that change are called *variables*. The variable that you (the scientist) change is called the *independent variable*. The response to the change is called the *dependent variable*. It is called a “dependent” variable because its value or condition “depends” on how the independent variable is changed.

Here's an example:

Let's say you have a ramp and a ball. If you tilt the ramp at a certain angle and roll the ball down the ramp, the ball will roll at a certain speed. If you make the angle of the ramp

steeper, the ball will roll faster. In this case, the ramp angle is the independent variable (the one you can change) while the ball's speed is the dependent variable (the result of the change).

A very common scientific procedure—one that you will follow many times in these labs—is to make regular changes in an independent variable and watch the changes that occur in a dependent variable. By observing the pattern of changes, you will come to understand how certain independent variables and dependent variables are related. The relationship among variables is often the key to solving your real-life problem.



	Ramp Angle	Ball Speed
Trial 1	25°	1.5 m/s
Trial 2	10°	1.0 m/s

**Independent Variable:**  
 You change the ramp angle.

**Dependent Variable:**  
 Changing the ramp angle results in a change in ball speed.

**Plan**

When you are ready to write an experiment plan, click the **Plan** tab. Here you will find an outline of the steps you should follow. This tab also links you to useful resources like video clips and articles with more information.



You should review these resources along with the Briefing Document before you write your plan. You will not write your plan on the computer. You will write it in your lab notebook.

Writing the experiment plan may be the most important part of the Virtual Lab. It requires clear and organized thinking on your part. You have information from the Explore Lab and from the Plan tab resources. Ask yourself how you can use that information to solve the lab's real-world problem.

Your experiment plan should include these three sections:

1. **Testable question:** The question you will answer in your experiment;
2. **Hypothesis:** Your best guess about what the answer will be;
3. **Procedure:** The steps you will take to investigate your question and a description of the data you will collect.

Your teacher must approve your experiment plan before you move on to the Experiment Lab. While you wait, you can prepare a data table, if you will need one. Also set aside a space in your lab notebook where you can record any other observations you make in the Experiment Lab.



**What Is a Testable Question?**

A *testable question* is a question that can be answered by a simple experiment. To answer the question, you identify a variable that you can control, you change it, and then you observe the effect.

Suppose you were trying to balance a seesaw with a big child at one end and a smaller child at the other end. You might ask yourself: *Can I make the seesaw balance by moving the smaller child backward?* That question is testable. You can actually move the child and see the effect on the seesaw.

A different question about the same situation might be: *What does gravity have to do with this problem?* That question is not testable. You may suspect gravity is at work, but you can't test that.

Most of the real-life problems you get to solve in the Virtual Labs involve several variables, so there are many different testable questions that you might ask.

**What Is a Hypothesis?**

Your experiment plan should also include a hypothesis that states what you expect might be the answer to your testable question. A *hypothesis* is an educated guess about what will happen.

In the above example, your hypothesis might be: *I think moving the small child backward will help balance the seesaw, but there might not be enough room to balance the seesaw completely.* A hypothesis can include an explanation for your guess, but it doesn't have to.

### Experiment

Click the **Experiment** tab to return to the Virtual Lab to carry out the experiment you described in your plan. Follow your procedure, collect your data, and then write a short summary describing your results.

Your teacher will tell you when and how to share your results with your classmates. Other students may have gathered data about different testable questions. When you combine your results, you may have enough information to propose a solution to the lab's real-life problem. Such sharing and collaboration almost always play an important part in the work of practicing scientists who are trying to solve real problems.

### Have Fun

Don't be surprised if you don't find specific instructions about what to do in a Virtual Lab. The lab work is up to you!

Imagine that you are a scientist and this is your lab. You decide what question to ask and how to carry out your investigations. Try out your own ideas. Question what you see. Double-check your findings. Pay special attention to unexpected results. It's OK to make mistakes in the Virtual Lab. The only rule to follow is to keep being curious, skeptical, and open-minded.

As you work with your classmates to answer questions and solve problems, you will be doing the work of real science. And like scientists everywhere, you will be amazed at what you discover!