

User's Manual and Teacher's Guide for the

ScienceSchoolHouse™

# Discover!Science Library™:

Discover!Astronomy and Astronomy Explorer

Discover!Geology and Geology Explorer

Discover!Oceans and Oceans Explorer

Discover!Weather and Weather Explorer

Discover!Life in the Environment

Discover!Physical and Chemical Sciences

March 2010

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## Welcome

Welcome to ScienceSchoolHouse **Discover!Science Library**. The **Discover!Science Library** CDs are multimedia resources for students and teachers, and for anyone interested in investigating these amazing topics. This manual describes the library and also provides assistance in using it. It is not necessary to read the manual in order to use the library. However, especially for the 3D Virtual Lab component the manual provides assistance that is valuable to have in print, although such help and more is also found in each CD.

## SYSTEM REQUIREMENTS AND INSTALLATION

### System Requirements

#### *Minimum System Requirements*

**Windows:** 98, ME, XP, or 2000, Vista, plus multimedia capabilities.

**Macintosh:** OS9 or OSX; any G3, G4 or G5 including iMac, eMac or Mini; multimedia capabilities.

You must have QuickTime™ 6.0 or higher installed. The product will prompt you if you need to install it, and you need only to follow instructions. If required, you can install QuickTime by opening the QT folder on the CD and installing the correct version (PC or Mac), or you can download it from

<http://www.apple.com/quicktime/>

Your experience will be better if you set your monitor or graphics adaptor to 800 x 600 and high color or True Color settings.

The 3D Virtual Lab requires a fairly modern computer, graphics card and/or graphics driver and (for Windows) DirectX software. Anything made since year 2000 is probably sufficient. For older computers you may need to download a new graphics driver free from the graphics card manufacturer website, and/or download a new DirectX free from Microsoft.com, or you may wish to buy a new inexpensive graphics card. Any 3D accelerator graphics card should be sufficient (usually included in recent computers).

If you have any questions or problems, please check Support at

[www.scienceschoolhouse.com](http://www.scienceschoolhouse.com)

and if you still have questions email us at

[support@scienceschoolhouse.com](mailto:support@scienceschoolhouse.com)

## Installation Instructions

### *Windows*

Put the CD into the CD-drive. It should automatically begin. If it does NOT automatically start (your “autorun” is off), go to My Computer and double left-mouse click on the Discover!Science CD icon in the CD-drive shown. This should start the executable file (e.g., Ocean1.exe, Astronomy2.exe). If not, then right mouse click on the CD icon, select “Explore”, find the executable file, and left-mouse double-click it to start.

### *Macintosh*

Make sure your computer is awake, and then put the CD into the CD-drive. Double-click on the application file. If the CD's window does not immediately open, double-click the CD icon on the desktop, and double-click on the application file.

### *Non-CD Running and Network Installation*

Copy the entire contents of the CD into a hard drive folder on your computer, or on the server of your network. Next, make a shortcut on each client’s desktop (or your own desktop if just one computer) pointing to the proper executable file.

## Documents

You can access this manual and a manual for each **Discover!**Science CD from the Docs folder on the CD in Word and Adobe Acrobat Reader PDF formats. If you do not already have it, you can install Adobe Acrobat Reader, available at <http://www.adobe.com/> and you will be able to view the PDF file.

The Test Banks are also available in the Docs folder.  
For Answer Keys, go to [scienceschoolhouse.com/answers](http://scienceschoolhouse.com/answers)

There may also be other files in the Docs folder that are used with the courseware.

# ScienceSchoolHouse Discover!Science Library

## Introduction

Each title in the Discover!Science Library is a complete educational experience covering science topics with a comprehensive breadth and depth that can usually only be found in textbooks. However, because it is computer-based interactive multimedia, it supplies many educational materials that cannot be found in any textbook.

Each title in the series has five core components:

- **Interactive multimedia tutorial**
- **Quizzes and extensive test banks**
- **3D Virtual Laboratory**
- **Full 25-30 minute Video Documentary (not in the Explorer Series)**
- **Curriculum Documents**

Each title in the series has unique educational content, except for the 3D Virtual Lab and some exercises, and appendices (some of which are common to all).

This library is an exciting educational resource for teachers and students to learn about earth and space sciences and fundamentals of physical, life and chemical sciences, plus active application of science methodologies.

## Discover! compared with Explorer

An Explorer CD has most of the content of a set of 3 Discover! CDs, except that, due to the total amount of content, there is only one level of Main Chapter text and there is no Video Documentary. The Explorer CDs are compilations of most of the educational material in the Discover!Science Library. Even with only one level of Main Chapter Text, there are still many levels of educational material.

## Components of the Discover!™ Science Library

Most educational courseware is based on the premise that the teacher and the textbook are the core references for the student. The addition in recent years of electronic media usually merely supplements these core pedagogical methods. In contrast, **Discover!**Science Library courseware is fundamentally computer-based, and print materials are a supplementary resource.

The **Discover!**Science Library CDs feature the following components:

### **Interactive Multimedia Tutorial:**

- Text in the Main Lessons and Exercises is narrated
- Two levels of text are available for choice by the student (one in the Explorer Series)
- Pop-up Enhancement Windows provide additional information, definitions, etc.
- Interactive Exercises and Projects of several types are found in each title of the series. There are about 100 exercises in the library.
- Movies and animations abound—there are hundreds in the series
- Appendices are offered for further study
- Glossary

The Tutorial has been designed from the point of view that the student jumps into it without prior preparation and explores the topics in the guided way that has been designed into the lessons. The teacher's role in this model is to fill in the details and gaps as **Discover!**Science introduces the student to the broad sweep of concepts in the earth and space sciences.

In this approach, the teacher becomes even more indispensable as the human voice that provides the local context and guidance for application of the broad principles that we present. **Discover!**Science courseware will liberate the teacher from long lecture sessions. The teacher should take the lead in guiding the students' use of this courseware.

Pop-up descriptions and appendices are used to present detailed text so as not to detract from the main flow of the logic. However, a full appreciation of the depth of the courseware requires extensive use of these features. In general, the level of detail increases as you progress from the chapter text, through the pop-ups, to the appendices.

### **3D Virtual Laboratory:**

Here, the student enters the Virtual Lab and conducts experiments in a complete 3D lab, including a lab bench, stored samples, instruments, and tools for analysis. Hypotheses are formulated/tested and data is collected/analyzed in dynamic, discovery-oriented experiments. Each student becomes a scientist, explorer and naturalist solving real-life problems while learning the basics of science and science methodology.

Note that for Version 1.2 and earlier the lab has only one series of experiments (with 100 variations). More experiments are being developed and will be made available for 1 year to all who purchased these versions. There will be many more experiments, plus the student will step “outside” to explore realistic 3D natural environments, explore, experiment and collect samples for testing inside the lab.

**Self-assessment Quizzes and Test Banks:**

Self-assessment quizzes for middle and advanced levels are directly accessible from the Module Selection Screen; Test Banks for both levels are in the DOCS folder on the root of the CD. For answer keys go to: [www.scienceschoolhouse.com/answers](http://www.scienceschoolhouse.com/answers)

**Video Documentary (not in the Explorer Series):**

A half-hour high-resolution digital video documentary featuring pre-indexed text descriptors that combine the visual impact of video with text reinforcement and one-click navigation.

**Manuals, Guides, How-To-Use videos, and Curriculum Correlations:**

The “How to Use Discover” module has a demo video and curriculum documents. We offer many other resources to help students and teachers use these materials in the classroom or at home. A demo CD accompanies your product. Visit [www.scienceschoolhouse.com](http://www.scienceschoolhouse.com) to view them or contact us at: [support@scienceschoolhouse.com](mailto:support@scienceschoolhouse.com)

## **Educational Philosophy**

*“Learning science is something that students do, not something that is done to them. “Hands-on” activities, while essential, are not enough. Students must have “minds-on” experiences as well.” National Science Education Standards, p. 2, National Academy Press, Washington, 1996.*

The **Discover!**Science Library is interactive multimedia courseware that encourages students to experience the richness and excitement of understanding the natural world. **Discover!**Science courseware integrates easily into the classroom and may be used as a main teaching tool or as a supplementary resource. The exercises, projects, movies, animations link reinforce state and federal curriculum standards. The text and graphic elements of the **Discover!**Science Library provide a comprehensive repository of scientific information - information that is both technically accurate and up-to-date.

Although a single resource, the multimedia and interactive nature of each **Discover!**Science CD engages those who require auditory, visual, reading and doing experiences. The **Discover!**Science Library provides straightforward explanations for difficult concepts. The animations, movies, interactive games and projects bring the text alive.

As a comprehensive multimedia study guide, the software can also augment traditional media and improve students' level of academic achievement. Material and activities in the **Discover!**Science courseware can be easily embedded within the framework of classroom instruction, "hands-on" activities, self-paced learning or home study.

The Four Foundations of science education guided the development and enhancement of the **Discover!**Science Library of CDs. These Four Foundations are the cornerstone of any resource that aims to teach science. We teach:

- Attitudes about science that promote curiosity and skepticism, personal involvement and team cooperation
- Skills in conducting science, especially how to perform experiments and analyze results
- Knowledge of scientific facts, principles and theories in an interdisciplinary presentation
- Concepts of science, technology, society and the environment (STSE)

There are two basic styles of presentation that we combine and integrate:

- **Instructive** presentation that provides the results of scientific inquiry
- **Constructive** presentation that promotes discovery in open-ended ways

The substance of educational instructive materials is found in the text, narration, graphics (illustrations, photographs), animations and videos.

The substance of educational constructivism is found in four places:

1. Interactive Exercises are more structured demonstrations and/or experiments that sometimes allow the student to make errors and find false results. You, as instructor, need to perform these and understand the benefits and pitfalls to assist your students.
2. Mini-exercises are scattered throughout the text, sometimes in pop-up windows. These provide the student with guidance, but the general message is "go forth and be curious". You, as instructor, have little beyond our suggestions, which the student can see also, to guide you. However, the point is that individuals follow their own curiosity.
3. The 3D Virtual Lab provides hands-on experimentation, and application of the scientific method complete with data collection and analysis.

We apply the guiding principle that students can understand even complex concepts if assisted and directed properly. These concepts and presentations are provided through a mixture and integration of all of the content components:

- In the Interactive Tutorial, each of the Main Lessons have as few as 8 and as many as 26 screens, and each screen contains two levels of text (except in the Explorer Series),

plus a photograph, illustration, diagram or chart, plus most of the screens have at least one additional interactive multimedia component (movie, animation, interactive exercise or project). Main lessons and exercises are narrated.

- Appendices typically have more text, and some do not have graphics.
- Within the Main Lesson text, some of the words are colored blue and underlined. Clicking on one of these words with the mouse results in a Pop-up Window with either a definition or an enhancement.
- Within some of the Main Lesson screens are buttons that connect to Movies, Animations, Interactive Exercises, Projects, Slide Shows or Movie Shows.
- Some of the movies and animations are extended animated lessons.
- There are several Interactive Exercises and Projects. Many of these form the main Constructivist presentation style incorporated within the CDs. The interactive exercises and projects are designed to offer experiments and simulations to actually conduct scientific investigations, to help introduce or reinforce main lesson concepts, to test knowledge, and to provide a game-like environment within which to learn.
- The Interactive Exercises and Projects range in complexity from simple reinforcement of concepts to more detailed experiment projects. Others are simple demonstrations.
- There are Appendices that are designed for research purposes or as resources for those fundamentals (like “SI Units”) that are necessary in any complete presentation of science material. These should be integrated into lesson plans for the course, especially in open-ended assignments.
- With all of these levels of information, the CDs are also an excellent resource for teachers in elementary, junior and senior high schools who are not experts in the earth or space sciences, and a good reference for those who are.
- With the middle level text selection feature for younger students (grades 5-8), the Main Lessons, most of the Pop-up Windows and most of the exercises and projects can be used as direct teaching resources. Younger students can use some of the Appendices. With the advanced level text selection feature, students in higher grades, or advanced, motivated students in the younger grades, will be challenged when reading the Main Lesson text.

## **Using Discover!Science in the classroom or at home**

The manner in which **Discover!Science** courseware is integrated into the classroom often depends on the number of computers available and the computer / student ratio. Some classrooms may be able to provide a computer and courseware for each individual student, while others may have a single computer or have all computers in a computer laboratory that is physically separated from the classroom. **Discover!Science** courseware can be integrated into any classroom. However, teachers can consider various strategies

according to the number of computers and courseware CDs in their classroom and school.

All students with individual access: The options are greatest where each student has access to his/her own computer and a **Discover!**Science CD. In this case, teachers can direct students to perform particular courseware activities within the ongoing context of classroom discussion. The courseware allows all students to progress through the essential material, while at the same time providing the more ambitious students with the opportunity to dig a little deeper into the subject matter, and so receive a greater challenge.

In many classrooms the number of computers is less than the number of students in the class. In this case there are basically two ways to provide student access to the computer and courseware - simultaneous access within groups or individual access at different times. Other teaching situations include the case where there is only one computer in the classroom or where computer activities must be conducted in a separate computer lab or session.

Simultaneous access in groups: In cases where there are insufficient computers for each student to have his or her own computer, one approach is to divide the class into small groups where the number of groups equals the number of computers available. This approach provides all the groups with access to the computer and the courseware at the same time. With this approach, computer activities can be integrated with classroom discussion, just as in the case where there is one computer per student. The major difference is that groups of students, rather than individuals, interact with the computer and courseware. For example, a class of 30 students with access to 6 computers would require that the class be divided into 6 groups with 5 students in each group. Each group of 5 students would have concurrent access to a computer and the **Discover!**Science courseware.

This approach works well provided the groups are small, with 5 or fewer students per group. Having the students work in small groups (“pods”) promotes teamwork and interaction with peers, a necessary part of personal development. Within each small group of students, one student could be assigned the role of team leader and be designated as the “holder of the mouse”. The leader would be responsible for the team’s progress through the required segments of the courseware. Another team member could be assigned the duties of recording the team’s answers to the questions posed in the preceding class.

Individual access at different times: Another approach is to divide the class into several groups where the number of students in each group is equal to (or fewer than) the number of computers available. These groups then take turns using the computers. This implementation gives each student the sole use of a computer and the **Discover!**Science courseware whenever his or her group is the group using the computers.

As an example, a class of 30 students with access to 10 computers would be divided into 3 groups, with 10 students in each group. Each group of 10 students would take a turn on the computers. With one-third of the class engaged on the computers, the remaining two-thirds of the class could be involved in other classroom activities, such as “hands-on” experiments, a laboratory exercise or a classroom discussion.

Only 1 computer/classroom: In many classrooms the number of computers available is significantly less than the number of students in the class. The extreme situation is where there is a single computer in the classroom and the computer and the **Discover!Science** courseware must be shared among all the students. In this case a number of alternative strategies may be implemented, with the teacher assuming a major role as the team leader. If the necessary equipment is available, specific multimedia elements like movies and animations can be displayed on an AV projection screen for viewing by the entire class. The teacher, as “holder of the mouse”, can also proceed through many of the interactive exercises, and follow suggestions proposed by the class.

Self-paced learning: Students can also use the courseware individually, or in small groups, as part of a separate “computer session” or at home. **Discover!Science** courseware functions as a tutor, allowing students to progress through the activities at their own pace. This allows students to use the courseware at any time they have access to a computer and the **Discover!Science** courseware. Students can catch up on material covered in missed classes during free periods, computer laboratory sessions or even their lunch hours. Schools can adopt a sign-out system for the courseware, for students who have access to home computers.

## **Titles in the Discover!Science Library**

The ScienceSchoolHouse **Discover!Science Library**<sup>TM</sup> currently (August 2005) consists of the following 19 CDs, each of which is chock-full of educational materials:

### **Discover!Geology Series**

Dynamic Earth

Minerals, Rocks and Resources  
Carving the Earth: Soils, Erosion and Landforms

**Discover!Oceans Series**

Earth's Oceans  
Oceans in Motion  
Earth's Water Cycle

**Discover!Weather Series**

Weather Fundamentals  
Extreme Weather  
Weather Forecasting and Climate Change

**Discover!Astronomy Series**

Astronomy and the Universe  
Earth and the Inner Solar System  
The Outer Solar System

**Discover!Life in the Environment Series**

Life Science  
The Environment

**Discover!Physical and Chemical Science**

**Explorer Series**

Discover!Weather Explorer (Weather Explorer)  
Discover!Oceans Explorer (Oceans Explorer)  
Discover!Geology Explorer (Geology Explorer)  
Discover!Astronomy Explorer (Astronomy Explorer)

In addition, EOA Scientific has developed other titles that provide □in-depth or special topics in science education:

**Earth Science Overview Courseware**

Earth-Ocean-Atmosphere-Space Explorer  
EarthMission

**Project Courseware**

Satellite Remote Sensing Analysis WorkStation  
Project WorkStation

**Special Topics**

Mapping Our World: All About Maps  
Mission Climate

### **Earth and Space Science Videos on CD and DVD**

(3 ~30-minutes videos on each CD or DVD) Note: Videos on CD are smaller-size QuickTime™ chaptered movies for computer and network applications. Videos on DVD are standard, full size DVD videos with full scene navigation.

#### ***Astronomy I***

*Changes in Outlook from Ptolemy to Einstein*  
*The Space Shuttle and the Hubble Telescope*  
*Spaceflight: The Application of Orbital Mechanics*

#### ***Geology I***

*Exotic Terrane*  
*The Reelfoot Rift*  
*When the Bay Area Quakes*

#### ***Volcanoes I***

*20 Years of Climbing Volcanoes*  
*Hawaiian Volcanoes*  
*Alaskan Volcanoes and Mt. St. Helens*

#### ***Nature's Fury I***

*Hurricane Force - A Coastal Perspective*  
*Flooding - Working on Prevention*  
*Wild Fire! - Forest Fires and Firefighting in the U.S.*

#### ***Environmental I***

*Muscles and Bones*  
*Earth from Space*  
*Hurricane Force*

#### ***Oceans I***

*Images of Earth and Jason*  
*Earth's Oceans from Space*  
*Seawinds and Quikscat*

### **VHS Videos**

Fourteen half-hour earth and space science videos. Check [www.scienceschoolhouse.com](http://www.scienceschoolhouse.com) for titles.

## Contact Us

We are EOA Scientific Systems, Inc., developers and marketers of interactive multimedia learning resources in earth, space, life, physical and chemical sciences.

EOA Scientific Systems, Inc.  
11-A Parkhill Road  
Halifax, Nova Scotia  
Canada B3P 1R2  
Toll Free: 1-888-666-6362  
Tel: (902) 477-1908 Fax: (902) 477-6834

[www.eoascientific.com](http://www.eoascientific.com)  
[www.scienceschoolhouse.com](http://www.scienceschoolhouse.com)

[salesinfo@eoascientific.com](mailto:salesinfo@eoascientific.com)  
[techsinfo@eoascientific.com](mailto:techsinfo@eoascientific.com)

# How to use the Courseware

## Getting Started from the Module Selection Screen

If you need to make adjustments to your graphics display settings as suggested, please do so now. The best resolution is 800 x 600.

The Welcome screen is the first screen you will see. Click on Start. You may see a Plugin Detection screen that allows you to install the necessary plugins. Next, you will see the Options screen. Select Middle Level or Advanced Level text, then Run Program. The Module Selection Screen will appear.

The Module Selection Screen has five options, reflecting the five Main Modules of Discover!Science:

- Interactive Multimedia Tutorial
- Virtual Laboratory
- xMedia Movie Player (not in Explorer Series)
- Quiz
- How to Use Discover!

There is also the option to Exit (Quit) from any of the preceding screens.

## Interactive Multimedia Tutorial

### Introduction

From the Module Selection Screen, click on the Interactive Multimedia Tutorial, and the Main Menu screen appears.

The Main Menu is a tool for students and teachers to explore the Tutorial. One major way to explore is to start with the Topics category, go to Lesson 1, and go linearly through all the screens. All of the content components are found in this way in a logical sequence that presents foundations and enhancements.

However, if you wish, you may browse the entire CD and just explore the topics that you select by using this Main Menu. Just select from the content components listed (Topics, Exercises, Movies, Appendices). Glossary, Help, text-based Contents and Quit are also available from this Main Menu. The Glossary has literally thousands of concise definitions.

### *Components of the Interactive Multimedia Tutorial*

- **Main Chapter Text, Narration, Pictures, Pop-up Windows:** Text presented on Main Lesson screens and in pop-up windows is written at two reading comprehension levels, middle and advanced (only middle level in the Explorer Series). The text is much more expansive and scientifically oriented than is found on most multimedia CDs. Main Lesson text is fully narrated for both reading levels.
- **Interactive Exercises:** Computer-based activities and exercises that demonstrate concepts and reinforce particular learning outcomes. The interactive exercises present difficult science concepts in an invigorating, non-text medium that allows students to learn through experiencing, not memorizing, the material.
- **Movies:** Vivid movies that present “real world” examples of scientific phenomena and provide students with experiences unavailable in the static world of textbooks.
- **Animations:** 3D and 2D animated sequences that describe natural processes such as sea floor spreading, the hydrologic cycle, and much more. Animations illustrate scientific concepts that are difficult to explain through text alone and that are difficult or impossible to catch on film.
- **Graphics:** Brilliant, high quality (24-bit) color photographs, diagrams and charts.
- **Glossary:** A detailed glossary of over 2,600 scientific and technical terms.
- **Appendices:** Three appendices are common to each CD: Scientific Method, Measurement Systems and SI Units, and Careers in Science. Some additional appendices contain more technically oriented scientific information and are designed for research purposes.
- **Bookmarks:** Users can bookmark favorite locations on each CD. Teachers can bookmark sections to lead students’ navigation through the material. The Bookmarks feature can be used by teachers to build lesson plans and by students to mark sections of the material that they wish to review. Because there is no installation to your hard drive, bookmarks are lost when you exit the CD.

## Navigating in the Tutorial Main Lessons

Click on Help for navigation information. Also, click on all the options you see and you will soon learn how it works.

The Main Lesson interface displays an inset screen on the left side that contains photographs or diagrams and a Text Selection (middle or advanced level) icon, and also may have an icon that connects to an Interactive Exercise or Project/Experiment; a film icon to click to a Movie or an Animation; a slide icon for Slide Shows; or a graphic icon for Charts. On the right is a potentially scrollable text field.

Within the Main Lesson text screens and in some Appendices are blue highlighted and underlined words that link to Pop-up windows or enhancements that explore the concept being presented in more depth. Short exercises to reinforce topic concepts are also available in some Pop-up windows.

The navigation buttons are located in the bottom-right corner of the interface. Also at the bottom of the interface are Narration off/on, Menu, Lab, Print, Help, Calculator, Bookmarks and Glossary.

### Navigation Buttons and Interface Features

- **Back Button:** This button takes you to the previous screen. It is sequential and steps back to the previous screen in the current chapter, or if you are on the first screen of a chapter, it takes you to the last screen of the previous chapter.
- **Next Button:** This button takes you to the next sequential screen, or if you are on the last topic of a chapter, it takes you to the first screen of the next chapter.
- **Exit Button:** This button allows you to exit to the Module Selection Screen.
- **Logo:** Connects to EOA's website.
- **T Button:** Allows you to switch between middle level and advanced level text (not available in Explorer series).

At the bottom of the interface are the following:

- **Narration:** Click narration off or on.
- **Menu:** Takes you back to the Main Menu. From here, you can access the Module Selection Screen. From the Module Selection Screen, you can access the Virtual Laboratory, xMedia Movie Player and the Self-assessment Quizzes.
- **Lab:** Takes you directly to the 3D Virtual Laboratory.
- **Print:** Allows you to print the screen.
- **Help:** Takes you to the Help screen.
- **Calculator:** Allows you to perform basic math functions.
- **Bookmarks:** You can add and delete screen bookmarks. Clicking on a screen from the list will take you to that screen. Because there is no installation to your hard drive, bookmarks are lost when you exit the CD.
- **Glossary:** An extensive glossary of literally thousands of concise definitions.

Multimedia Icons that may be on a screen interface:

- **Interactive Icon:** Click to access an interactive exercise or project.
- **Movie Icon:** Click to access an animation or a movie.
- **Slide Show Icon:** Click to access a slide show.
- **Chart Icon:** Click to access a chart.

### xMedia Video

The xMedia Player will display an approximately 30-minute video on the topic presented in each particular CD. Each video is indexed by sections so that you can jump to a particular location in it for review. The controls are self-explanatory.

## **Quizzes and Test Banks**

The Quiz module of the CD includes 5 questions for each Main Chapter of each CD in each of middle-level text and advanced-level text (only middle level in the Explorer series). These questions are for self-testing, hence the correct answers are shown after two tries.

There are an additional 5 to 10 further questions, along with the 5 self-testing questions, in a set of Test Bank documents in the Docs folder of each CD. These documents are in two formats, PDF for reading by Adobe Acrobat Reader, and TXT format for reading by any text reader, Notepad, Simple Text, or Microsoft Word. Using the TXT format, the teacher or parent may select questions and develop different quizzes or tests to assess student progress.

The Answer Keys for the Test Banks can be obtained by going to [www.scienceschoolhouse.com/answers](http://www.scienceschoolhouse.com/answers).

## **How To Use Discover!Science**

This module provides access to documents, videos and help guides to assist you in using the **Discover!Science** CDs.

Included are the manual for each product with comprehensive listings of the components and elements. Additional documents display correlations to curriculum standards.

You can also access a video that demonstrates how to use the various components of **Discover!Science**. Further videos with more detail can be found at [www.scienceschoolhouse.com/support](http://www.scienceschoolhouse.com/support).

A Demonstration CD also accompanies the courseware.

## **3D Virtual Lab**

### ***Getting Started Experiment: How to navigate the 3D Virtual Lab***

The first thing you need to do is play with the controls and learn how to control samples and instruments. If you have started to play and are getting confused, go to the Menu at the top and select Virtual Lab, then Reset Lab.

We have made many of the controls similar to those in many popular computer games, so some of these instructions may be simple to experienced game players. However, we have several surprises since we do many things that are not found in games. Even experienced game players should read the instructions first.

Now start playing with the controls.

### ***The parts of the 3D Lab***

Before you move anything, let's name the sections of this main screen of the 3D Lab. The main section with the 3D scene of the laboratory is the **3D Lab Scene** or the **3D Scene**.

You are in a science lab with a Lab Bench in the middle of the room.

The top menu system is called the **Menu**.

To the right is the Instructions panel, and just below that are

- 1) the **Information** area,
- 2) the **Record** button for recording your data and
- 3) the initial **Data display** panel.

At the bottom right is the **Property Inspector** button.

Just below the Property Inspector button is an **object selection display** panel that shows which object has been selected. It is blank at the start.

At the bottom of the screen is the **Tabs** section.

Just above the Tabs section are the **Status Indicator Lights**.

### ***Mouse Move Mode***

1. When the 3D Lab first starts put one hand on the mouse and the other on the left side of your keyboard. Rest your fingers on the A, S and D keys, just to the left of where you would normally place them for typing. (Caps are not required; we just use caps to identify the key.)

2. Now look at the Indicator Lights just above the Tabs. When you start the 3D Lab it shows a green light for the Lab View, and no lights for the others. We will explain Lab View and the Object View later. For now, move your mouse cursor around the 3D Lab Scene and notice that nothing happens when you do that.
3. Now put the mouse cursor arrow in the middle of the 3D Lab Scene and with your hand that is resting on the keyboard keys press the M key on your keyboard. The MOUSE MOVE Indicator Light will come on, showing that you are in Mouse Move mode. Slowly move the mouse cursor around the 3D Lab Scene, to the left, right, up and down. Note that if you are reading these instructions from the Instructions Window, then the 3D Scene will move every time you go to the Instructions Window to scroll down. You may want to hit the M-key again each time to turn off the Mouse Move. Or not, as you wish.
4. There is a section in the middle of the screen where moving the mouse will NOT move the scene. Then, when you move the mouse cursor outside of that area the scene will rotate. If you move it left, the scene will rotate to the left as if you are turning around. Same for towards the right. Move the mouse left and right to get a feel for it. Then try up and down. Then center it again.
5. Note that the farther you move the mouse away from the center of the scene the faster you rotate. If you just put the mouse near the edge and let go of it the 3D Lab Scene will rotate by itself. To stop it just move the mouse back into the center of the 3D Lab Scene. Try to find the border where you don't rotate at all and where you rotate very slowly.

### **The Airlock Door and the “front” of the Lab Bench**

In your rotation around the 3D Lab Scene, you will see an Airlock Door on one wall. This door has a Door Handle in the shape of a hand. Don't click on that just yet. That will take you outside, but there is nothing much to do out there yet. We call the “front” of the Lab Bench what you see when the Airlock Door is behind you, so that what you see in front of you is the wall with just a window, and the Lab Bench is taking up a large part of the 3D Lab Scene.

### ***Keyboard moving***

1. Now use the keys to move around. The A and D keys slide your view horizontally left and right. Try it. The W and S keys move you horizontally forward and back. The Q and Z keys move you vertically up and down. Try each of them one after the other.

2. Note that the W and S keys move forward and back HORIZONTALLY in relation to the Lab, not in relation to the view you have. So, if you are looking down, and press the W key, you will move horizontally across the Lab room, not down. Similarly, the A and D keys move you left and right horizontally in relation to the Lab, and the Q and Z keys move you VERTICALLY in relation to the Lab. Hence, if you are looking down, and want to go downward, you need to press the Z key, not the W key. Only one key at a time will work. This may all be confusing at first if you are not an experienced game player. Just be patient, play around with the controls and see what they do.

### ***Darkness all around—Where am I?—and—Hey, I'm stuck!***

1. If you ever get stuck with just darkness in front of you, then you are probably looking at the lower part of the Lab Bench really close up. Pull back using the S key, and/or go up using the Q key and you will probably see where you are.

2. If ever you get lost or confused in your scene, go to the Menu at the top, select Virtual Lab, and then Reset View in the sub-menu. That will position you in front of the Lab Bench.

3. If you get stuck and the scene is not moving when you think a control should move it, you may be stuck in a corner or against a wall behind you. Try moving forward using the W key or in another direction, and then the controls should work fine. Just as in real life, you can back yourself into a corner!

4. If you are still stuck, and nothing will make you move, press the M key to turn Mouse Move off and then go up to the Menu, select Virtual Lab and then Reset View. Then position the mouse in the middle of the 3D Lab Scene, press the M key again and start over. This shouldn't happen once you learn how to move around.

### ***Mouse and keys together***

Now try both the MOUSE and the KEYS at the same time. Remember, only one key will work at a time, but you can use any of the keyboard control keys and the mouse at the same time. If you use the mouse to rotate to the left, and then use the W key to move forward, you will rotate and move forward at the same time. Try different combinations, move around the Lab, get a feel for it. Get to the point where you can move forward and rotate around the Lab without hitting the walls.

### ***Moving an object around the 3D Lab Scene with mouse and keys***

1. Now, position yourself looking at the Lab Bench from the front so you can see most of it from the front view. Position yourself a little higher than the Lab Bench, looking down at a slight angle. In this way you can see the top surface of the Lab Bench, as if you were standing in front of it but not too close. Remember, the “front” of the Lab Bench is the wider part with the Airlock Door behind you.

2. Turn the Mouse Move function off by pressing the M key. The Mouse Move Indicator Light will go out. Go to the Tabs at the bottom of your screen, and click your mouse on the Sample Tab. Then click on the ball, which is called the “Spherical Sample”. (The default Sample is an 8 inch lead ball.) You will see the lead ball on the Lab Bench. If you don’t see it, then move around until you do. Put your mouse back in the center of the scene and then press the M key again. Notice that the Mouse Move indicator light is on.
3. Now move up close to the ball by using the keys and mouse. Then pick the ball up with the mouse. To do this, point your mouse cursor arrow at the sample, and click the mouse button. Keep holding down the mouse button while you move the mouse. If you are in Microsoft Windows, use only the left mouse button. Now move the ball around as you move the mouse around the 3D Lab Scene. First just move the ball around with the mouse, without the keys.
4. Now also use the keys as you did before, while holding the ball and moving with the mouse. Note that the ball will follow along with the Mouse Move function to rotate around the scene. As you move with the keys and move with the mouse, the ball will move along. Try this left, right, up, down, forward, back and with or without the mouse moving.
5. Play with moving around the Lab while holding the ball until you are comfortable going wherever you want. Put the ball on the Lab Bench, shift your view, pick it up again. Throw the ball around the room, find it on the floor, pick it up and put it on the Lab Bench. Do this sort of thing until you get the hang of it.
6. Remember, to move the ball and place it on something it is easiest to get fairly close before picking it up. By “fairly close” we mean that the ball should be about the size of a dime. You will have to get the feel for this to apply to certain tasks to come.

### **Grab Mode**

1. The G key will allow you to grab the ball and hold it in mid-air. Press the G key and you will see the GRAB MODE indicator light go on. Place the ball above the Lab Bench, hold it still, and then let go of the mouse button. The ball will just stay still. If you were moving the ball when you let go of it, the ball may be moving in mid air. Grab it again with the mouse and bring it into the center and hold it still. Then let go. Move around the room, up and down, looking at the ball. Move the ball with the mouse and the keys, keeping it with you while in Grab Mode.
2. Without holding the ball with your mouse, and while the ball is just sitting in mid-air while in Grab Mode, use the R and F keys (Rearward and Forward) to move the ball forward and back.

3. The Grab Mode is a really easy and important way to move a sample carefully to place it onto an instrument or tool. If you ever have trouble placing objects on other objects, the Grab Mode will help.

### ***Forward and “Rearward”***

With the Grab Mode off (press the G key again to turn the Grab Mode function and indicator light off) put the ball onto the Lab Bench. Now use the R and F keys to move the ball on the table. Note that it rolls on the table, not directly toward or away from you.

### ***Object View***

1. There is another mode of moving around the scene when you have a sample such as the ball. Normally you are in what we call Lab View Mode. In the Lab View Mode the mouse and keys move you in relation to the 3D Lab Scene. If you have a sample, such as the ball, in your 3D Lab Scene, and click on it, we say you have “selected an object”. The name of the object will show in the Object Selection Display panel (the box just below the Property Inspector at the bottom right of the screen). Select the ball that you have been playing with. Note that the Object Selection Display panel shows “Spherical Sample01”.

2. Press the V key, and you will be in OBJECT VIEW mode. Check the indicator light above the Tabs section. Now, when you move with the mouse or the keys, the ball will stay in the center of your screen. Try this with the keys and the mouse. You will see that the keys don’t function just as they did before, because the sample has to stay in the center. Object View Mode is very useful in helping to move samples with precise movements. Use all the keys to see how they work in Object View.

### ***Where did that ball go?***

1. If you are in Object View mode, we say that the object will be in the center of your screen. However, if it is behind another object, like the Lab Bench, then you will not see it. But it’s still there. To see it, you must have a line of sight — we don’t have X-ray vision here in the real virtual world.

2. If you can’t find the ball, then it is probably just hiding somewhere on the floor in a corner or behind the Lab Bench. Just as in a real lab, you have to keep track of your samples and equipment. It’s probably around somewhere. Keep looking. If you really can’t find it, make sure its name (Spherical Sample01) is showing in the Object Selection Display panel, and press the M key to get out of Mouse Move mode. Then go to the Menu, select 3D Items and Remove Selected Item. If the item’s name is not showing in the Object Selection Display panel, go to the 3D Items sub-menu and click on Select Next Item until its name is showing, and then remove it. Then go back to the Sample Tab and put another ball into the 3D Lab Scene.

### ***Really careful placement, fine motor control***

1. Now go back to Object Mode by pressing the V key again. Check the indicator lights. Then position yourself in front of the Lab Bench, as before, looking slightly down at the top surface of the Bench. Press the M key to turn off the Mouse Move function, and then click on the Instrument Tab. Select the Laser Lab Stand. Then bring the mouse cursor to the center of the scene and press the M key again to turn the Mouse Move function back on. Then grasp the Laser Lab Stand and move it to the middle of the Lab Bench. Now go back to the Tool Tab and select the Drop Stage. Grasp the Drop Stage and put it on the Laser Lab Stand, about 3/4 of the way up the vertical rod. It will attach automatically once you have placed it near that position. In order to get it placed in the right position to attach, you may have to hold the Drop Stage with the mouse near the vertical rod, and then use the one of the keys to pull the Drop Stage backward or forward to get it to where it will attach. Try it until you get the feel for this and it does attach.

2. Once an instrument is assembled from two or more pieces, it will not move freely anymore, so put the Laser Lab Stand where you want it before you attach the Drop Stage. To move the Laser Lab Stand and the Drop Stage together you will have to remove the Drop Stage first. To do this, just grasp the Drop Stage and pull it off. Then move the Lab Stand and re-attach the Drop Stage.

3. Your task now is to get the Sample onto the Drop Stage, using the controls that you have practiced. Grasp the ball and move it with the mouse (Mouse View mode on) and with the keys so that it is positioned just above or on the Drop Stage, and then let go. You can also use Grab Mode to suspend the ball in mid-air to help you. Try it both ways. Try it several times — put the Sample on the Drop Stage, take it off and then toss the ball around. Then retrieve it, move around the Lab and come at the Lab Stand from a different angle. Do this several times until you feel at ease placing the ball on the Drop Stage.

4. Once you are able to perform these tasks easily, you will be comfortable doing many of the other tasks needed for the experiments.

## **Keyboard Controls and Shortcuts**

This is a list of the keyboard controls and shortcuts in the Virtual Lab.

### ***3-D movement controls***

*Key      Command*

- W** Moves you forward horizontally in Lab View Mode, or toward an object in Object View Mode
- S** Moves you backward horizontally in Lab View Mode, or away from an object in Object View Mode
- A** Moves you left horizontally in Lab View, or rotates you to the left around an object in Object View.
- D** Moves you right horizontally in Lab View, or rotates you to the right around an object in Object View.
- Q** Moves you up vertically in Lab View, or rotates you upward around an object in Object View.
- Z** Moves you down vertically in Lab View, or rotates you downward around an object in Object View.

### **Arrows**

The arrow keys also work like the W, S, A and D.

### **Numbers**

The numbers set the speed of the key-controlled moving, from 1 to 10, where the 0 is 10.

### **3-D View controls**

*Key*    *Command*

- V** Changes View Modes from Lab to Object or Object to Lab.
- M** Turns off the Mouse Move control for moving around the scene so you can go to the menus, tabs or other data entry areas, or turns

the mouse control back on.

**L** Levels your view so that you are looking straight ahead.

### **3-D Objects**

*Key Command*

**G** Grabs the selected object, and holds it in mid-air when you let go with the mouse.

**R** Moves the selected object away from you if you have grabbed it with the G-key, or rolls it away from you if it is sitting on a table or floor.

**F** Moves the selected object toward you (Forward) if you have grabbed it with the G-key, or rolls it toward you if it is sitting on a table or floor.

**+ or -**

The plus and minus keys select the next or last object so you can change to Object View around that object or so you can remove it from the scene entirely.

### **Lab View Mode: V-key Toggle**

This is the normal way of moving around a scene, which rotates your view in the direction you move the mouse. Check the View Mode Icons at the bottom of the screen above the Tabs to see how they show your mode. Note that there is a section in the middle of your scene where the mouse will not cause a rotation of your view. This is to allow you to perform your experiments when you don't want to move. Therefore, center your equipment in the scene to perform your careful placements of samples.

You start in the Lab View Mode. If you have changed to the Object View Mode with the V-key, then pressing the V-key again will get you back to the Lab View Mode.

### **Object View Mode: V-key Toggle**

If you are in the Lab View Mode, then pressing the V-key selects the Object View Mode. This always keeps the selected object in the center your view. You select an object by clicking your mouse on it. Your view will now always follow the selected item as you move it, or you will rotate around the item if aren't moving the item. Press the V-key again to go back to Lab View Mode. Check the View Mode Icons to see how they show your mode.

### ***Zoom and Slide: Arrow and WS AD QZ Keys***

The Up and Down arrows and the W and S keys move you forward or backward horizontally in Lab View, or move you in toward or away from an object in Object View.

The Left and Right arrows and the A and D keys move you left and right horizontally in Lab View, or rotate you leftward or rightward around the object in Object View.

The Q and Z keys move your view up and down vertically in Lab View or rotate you upward or downward around an object in Object View.

You may use the mouse to rotate and also use the keys to slide or zoom at the same time. However, two keys will not work at the same time.

### ***Moving an Object***

You are frequently asked to move objects carefully or place them on other objects as part of an experiment. This section explains how to do that.

If you have grabbed an object with your mouse, you can move it in some directions just with the mouse. If you also use the keys you can move an object in more directions. If you use the Zoom and Slide keys (WS-AD-QZ) while you hold an object with the mouse, then the object will follow, but only after you let go of the key. This is a very important method of putting the object onto platforms such as the drop stage for the Fall Time experiments.

If the object is resting on a table then you can use the R and F keys to move it away from or toward you, but remember that it will stay on the table, so it will not just move toward you by floating in air.

If you have grabbed the object with the G-key and have it held in mid-air, then the R and F keys will move it away from you or toward you directly.

If you need to be precise about placing an object carefully on another object, then it is very helpful to use the G-key in combination with the mouse and other keys to change your angle. You can try this in Lab View or Object View. One or the other or both will work well once you become at ease with the controls.

### ***Speed: Number Keys***

You can change your keyboard-controlled slide speed with the number keys. 1 is the slowest and 0 (10) is the fastest. Default speed is 4. Don't use the number pad on the right of your keyboard. Use the numbers above the letters.

### ***Mouse Move, or Menu Access: M Key***

Press the M key to prevent the mouse from changing your view so you can move to the menu, tabs, instruction window or record data/properties inspector. To select from the Menu items or the Tab items, or to enter data or change the sample properties, press the M Key. Press it again to get back to the selected Mouse Move Mode.

### **Level: L Key**

If the scene gets crooked, press the L Key to level the view. This should rarely happen. You may also select the Virtual Lab Menu item, and Reset the Camera.

### **Grab: G Key**

If you press the “g” key while you have grabbed a sample with your mouse, and then let go of the mouse, the sample will stay suspended in mid-air. Now you can move around to get a better view or be ready to put the sample somewhere. Press the “g” key again to let go.

### **Move Object: R-F Keys**

You can move objects. The R and F keys move a selected item forward or back. If it is on a tabletop, then it will roll forward or backward. If you have grabbed it with the “g” key, it will just move forward or backward in mid-air. If you move the item backward, and it hits a wall, then it may not move as you expect.

### **Mouse Controls Summary**

The mouse will do the following:

1. In Lab View Mode the mouse will move your view by rotating around your current position, left and right, or up and down. This rotation is like you standing in one place and turning around or moving your head up and down. Your view changes in relation to the Lab. In Lab View you can slide your view left and right (A and D) horizontally, move forward and back (W and S) horizontally, plus move up and down (Q and Z) vertically. Even if your view has changed, these keys move you horizontally or vertically in relation to the Lab, not in relation to your view.
2. In Object View Mode the mouse will move your view so that it rotates around a chosen object. This rotation is like you moving around the object. Your view changes in relation to the object. The A-D, W-S and Q-Z now move you around the object, not horizontally or vertically around the Lab.
3. You can switch from Lab View to Object View or back with the V-key.
4. With the mouse you can also grab objects and move them around, drop them or throw them. You will see the full effect of gravity.

## Weird Stuff

### ***Getting Stuck***

If you find that you can't move, then you may have backed into a corner or wall. Move forward with the W-key, and try again.

### ***Going Through Walls or Other Objects***

If a Sample, Instrument or Tool gets slammed into a wall or table, it may rarely go right through. This is a flaw in the software, and should not happen. If it does, try to keep hold of it and pull it back with the mouse. If it is lost, select 3D Items from the Menu, Delete the Item, and then select it again from the Tabs.

## Experiments

### ***What is an experiment?***

An Experiment is a set of environments, samples, instruments and tools, along with instructions for you to generate hypotheses (guesses about what will happen), perform measurements, and record and analyze data.

### ***Choosing an experiment***

The Lab will start you with all the environments, etc. that we have. For the first release of the Lab that includes all that is needed for the Weight and Gravity experiment. Therefore, you do not need to choose an experiment. Later, with many experiments, you will want to select the Experiment menu and the Choose Experiment sub-menu to select an experiment.

### ***Collecting Data***

When you take a measurement the data appears in the Data Panel. To record the data, click the Record button. See the Menus section of this document for more information.

## Interface

This is an overview of the Virtual Lab interface.

- \* **3-D Lab Scene** - the main window that shows the 3D Lab, within which you will perform your experiments
- \* **Instruction Panel** - right panel with text instructions
- \* **Lab Menu** - menu at the top of the screen
- \* **3-D Object Tabs** - 3D tabs at the bottom of the screen, with Global and Local Environments, Samples, Instrument and Tool tabs
- \* **Property Inspector** - to view and/or change the sample or instrument properties

- \* **3-D status bar** - indicator lights that show which features are functional
- \* **Message Panel** - Information as you need it
- \* **Data Panel** - displays data that you have collected
- \* **Record Data** button - to record your data: if you don't record it, it will not be recorded for you.

## Analyzing Data

### ***Making Tables***

After you have collected some amount of data and are ready to view it, select Experiment from the Menu and Analyze Data from its sub-menu. You can return here as often as you like as you collect more data. Remember, save your data often at least as a backup, and you can load it again anytime.

The data is saved in a text file that you can import it into Microsoft Excel or other spreadsheet software for further analysis. This section of the Lab offers some easy displays of your data in tables and graphs.

At the bottom of the analysis worksheet are three radial buttons and three list boxes, one each for Sample, Locale and Measurement:

- \* Radial buttons (little circles)—select one to order all your data in tables
- \* List boxes (rectangles with “All” or, if you click in the box, a list of all the options is shown—select only certain data for display in tables

Once you have selected a radial button, click Make Table to display the table of your data. If you have left the list boxes as “All” then all your data will show. Try several options of selecting different buttons and box choices to see how they look.

There is also a “Calculate derived data” button. For instance, if you are using the Weight and Gravity experiment this will say “Incremental fall time”. If you select this you will get the tables of the times and distances that you recorded of your samples falling from the drop stage.

### ***Making Graphs***

When you click on the Graph Data button, you can select certain data for graphing.

You can only put so many data lines on a graph, or it becomes impossible to figure out, so you may have to make several graphs to view and print your data. Select some things for graphing—measurements, samples and locales, and then select which measurement to graph—for Weight and Gravity it is distance over time, velocity over time, or acceleration over time.

## Printing tables and graphs

You can print the table anytime you like. After you click on the print button, a view of what you are printing will show. Then click again to go to a standard print interface that corresponds to your computer's operating system. You still have the option to cancel the printing or select a printer.

## **Analysis Menu**

The Analysis section has its own Menu and Sub-menus. The Menu and Sub-menus are different, depending on whether or not you are in the Tables or Graphs section:

### File

- Save data*
- Load data*
- Return to lab*
- Exit*

### Tools

In the Table section, there is a sub-menu Graphs that takes you to the Graph section.

In the Graph section, there is a sub-menu Tables that takes you to the Tables section.

In the Table section, there is a menu item that says Table

- Clear Table*
- Make Table*
- Print Table*

In the Graph section there is a menu item that says Graph

- Clear Graph*
- Make Graph*
- Print Graph*

### Help

- Help Guide* — this guide
- Online* — brings you to our website for more helpful information
- About* — about us, version numbers, etc.