

Welcome to Interactive Physics

Interactive Physics is the result of a decade-long collaborative effort between physics instructors, authors, publishers, and software engineers. It is correlated with National Education Curriculum Standards and it teaches your students the same real-world motion tools that are used by professional scientists and engineers.

To get started, install Interactive Physics and go through each step of the demonstration described below. We are confident Interactive Physics will be a valuable tool for your classroom. If you have any questions, please call us toll-free at **800.766.6615**

Step	Physics Concepts
1.2 Creating a falling block	Mass; freely falling objects; laws of motion; linear kinematics
1.3 Adding a velocity vector	Vector and scalar quantities; vector components; unit vector
1.4 Making a pendulum	Oscillatory motion; frequency and amplitude; rotational kinematics; centripetal force
1.5 Changing an object's appearance	Center of mass
1.6 Graphing the pendulum's motion	Graphs and measurements; motion diagrams
1.7 Changing gravity	Law of gravity; Newton's second law
1.8 Adding air resistance	Air resistance; non-conservative forces
1.9 Adding a spring	Spring oscillation; conservative forces; conservation of energy; kinetic and potential energy
1.10 Controlling the spring constant	Spring constant; natural spring length; equilibrium spring length
1.11 Collisions with a circle	Collision; elasticity; frictional forces; impulse and momentum
1.12 Attaching a picture to an object	Attaching pictures makes realistic and fun physics experiments
1.13 Adding sound	Sound waves; speed of sound; Doppler effect; sound frequency and intensity
1.14 Adding a curved slot joint	Roller coaster physics; motion in two dimensions; conservation of energy and momentum
1.15 Adding a force	Concept of force; Newton's first law; work and energy
1.16 Running demo files	Interactive Physics allows you to explore other physics topics, including: electrostatics, evaporation and condensation, gears, kinetic theory of gas, machines, magnetism, particle dynamics, projectiles and rockets, pulleys, rotational dynamics, static equilibrium, superposition of waves, and many more...

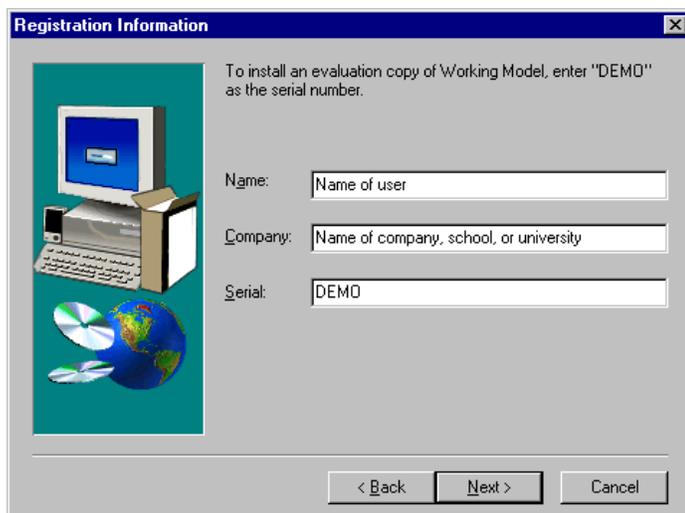
1.0 Installing Interactive Physics

Mac users:

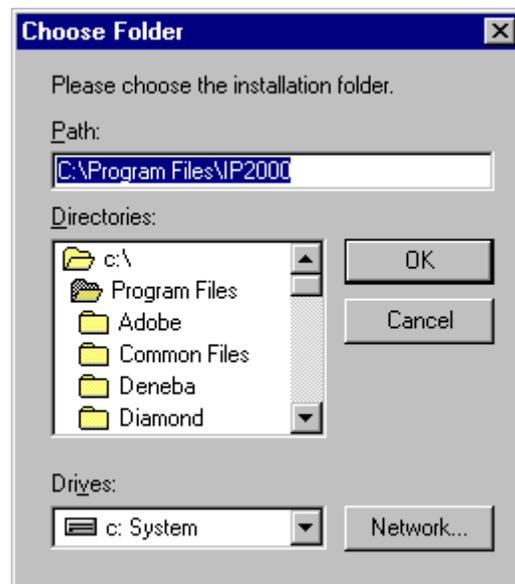
1. Insert the enclosed CD into the CD-Rom drive. Double-click on the IP2000 CD-icon
2. Double-click on the IP2000 icon in the IP2000 window. Follow the installation instructions
3. For a step-by-step introductory tutorial, turn to the next page.

Windows users:

1. Insert the enclosed CD into the CD-Rom drive and follow the installation instructions
2. When prompted for a serial number, type "DEMO"

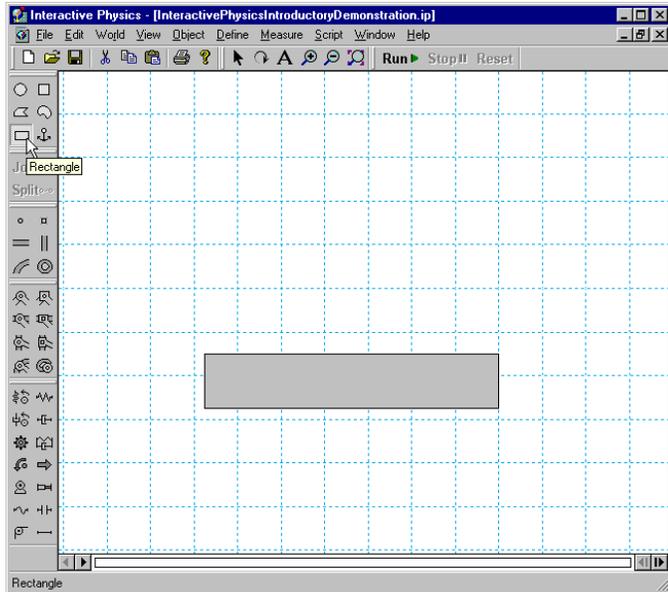


3. When the "Choose Folder" window appears, click [OK].
4. For a step-by-step introductory tutorial, turn to the next page.



1.1 Starting Interactive Physics

1. Ensure that Interactive Physics is installed on your computer.
2. From the Start Menu, click on Programs and then Interactive Physics 2000. This opens a new Interactive Physics document.



1.2 Creating a Falling Block

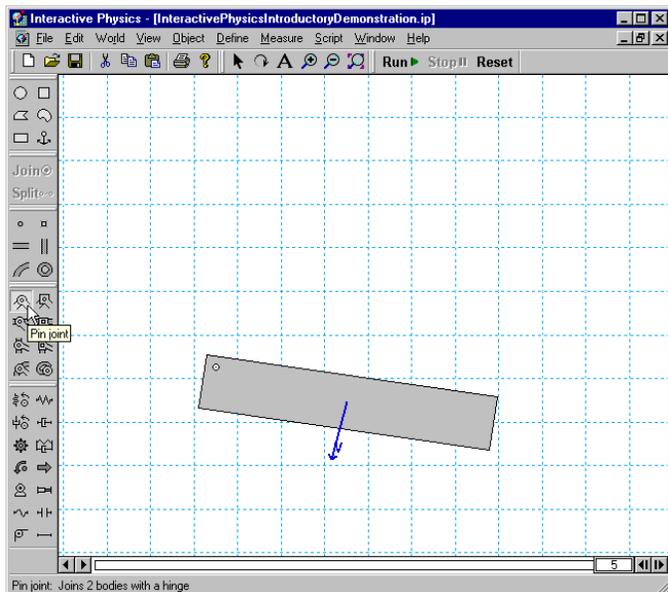
1. The first simulation is Newton's first experiment, dropping a block.
2. To draw a rectangle, click on the Rectangle tool, then click in the workspace and draw a long thin rectangular block.
3. To run the simulation and see the block fall due to gravity, click **Run ▶**.
4. To stop the simulation, click **Stop ||**. Click **Reset** to reset the simulation.

1.3 Adding a Velocity Vector

1. To add a velocity vector, click on the rectangle.
2. From the Define menu, click on Vectors and then Velocity.
3. Click **Run ▶** and observe that the vector changes magnitude as the block falls.
4. Click **Stop ||** and **Reset**.

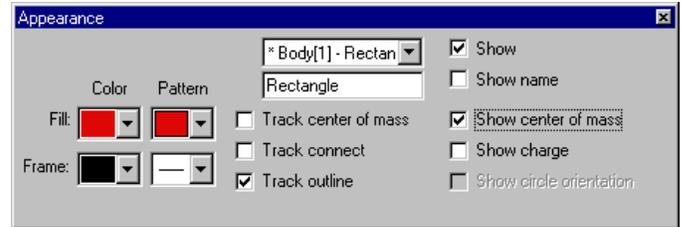
1.4 Making a Pendulum

1. To make a pendulum, click on the Pin joint tool and then click on the upper left-hand corner of the rectangle.
2. Click **Run ▶** and observe the pendulum's motion.
3. Click **Stop ||** and **Reset**.



1.5 Changing an Object's Appearance

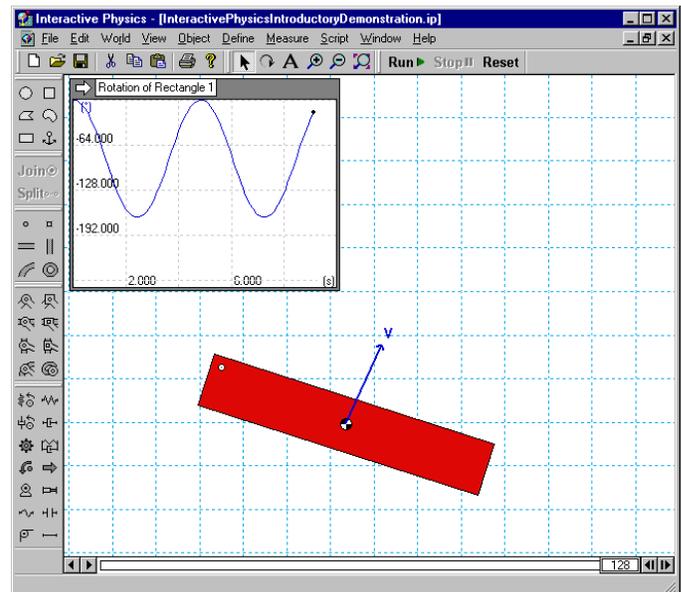
1. To change the appearance of the rectangle, double-click on it. Under the Windows menu, select Appearance. Change the fill color and click the box titled "Show center of mass."



2. Close the Appearance window and run the simulation again. Notice that changing the rectangle's appearance does not affect its motion.

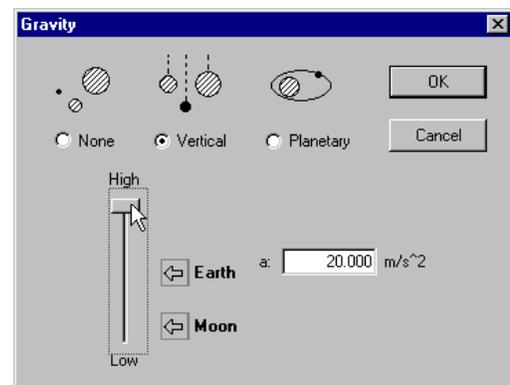
1.6 Graphing the Pendulum's Motion

1. To graph the pendulum's motion, click on the rectangle. Under the Measure menu, select Position, then select Rotation Graph.
2. To collect data, click **Run ▶**, the data can be displayed as a graph, a bar chart, or a number. (Notice that the data display can be changed while running the simulation.)
3. From the graph, the amplitude and frequency of the pendulum's motion can be determined.
4. To make the graph larger, click on the graph and drag its lower right-hand corner to the right.



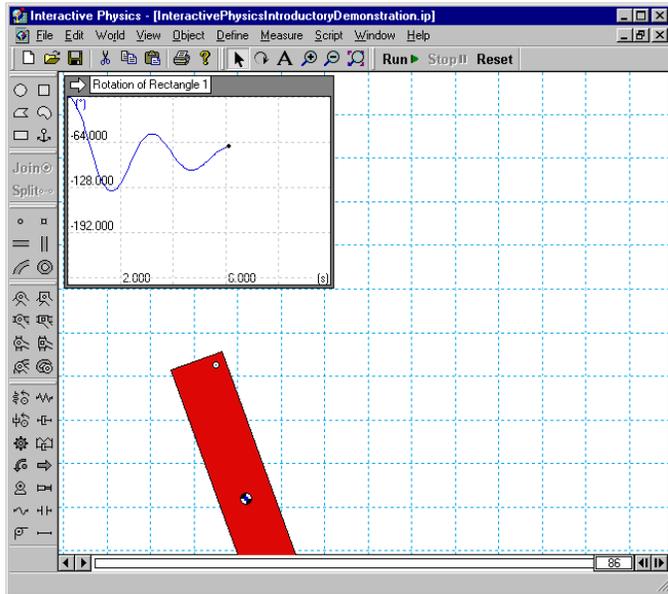
1.7 Changing Gravity

1. To change gravity, click on the World menu, select Gravity, slide the slider to the top for the value 20 m/sec², and click [OK].
2. Click **Run ▶** and observe that, in agreement with theoretical and experimental predictions, the pendulum has a higher natural frequency.



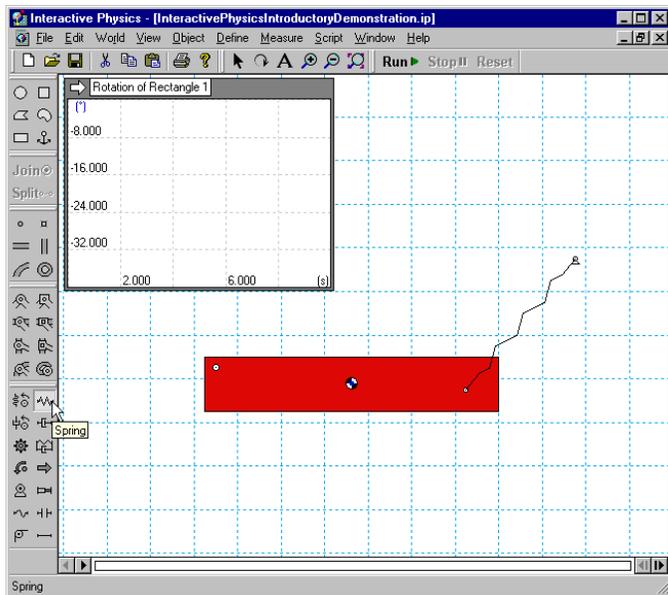
1.8 Adding Air Resistance

- Under the World menu, select Air Resistance, click on Standard, slide the slider to the value 1.0 kg/(m * s), and click [OK].
- Click **Run** and observe the exponentially decaying oscillations and notice that the pendulum's center of mass comes to rest directly below the pin. Click **Stop** and **Reset**.



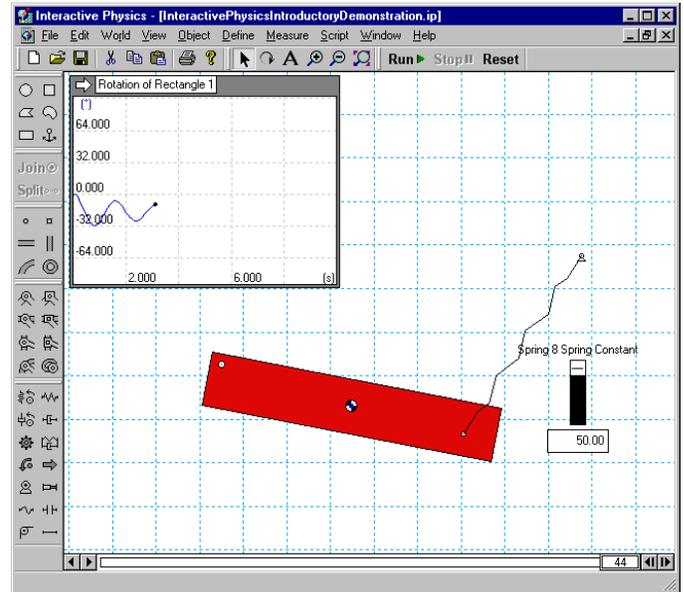
1.9 Adding a Spring

- To add a spring, click on the Spring tool. Click on the upper right-hand corner of the block and stretch the spring up and to the left.
- Click **Run** and observe the pendulum's higher natural frequency and new equilibrium position. Click **Stop** and **Reset**.



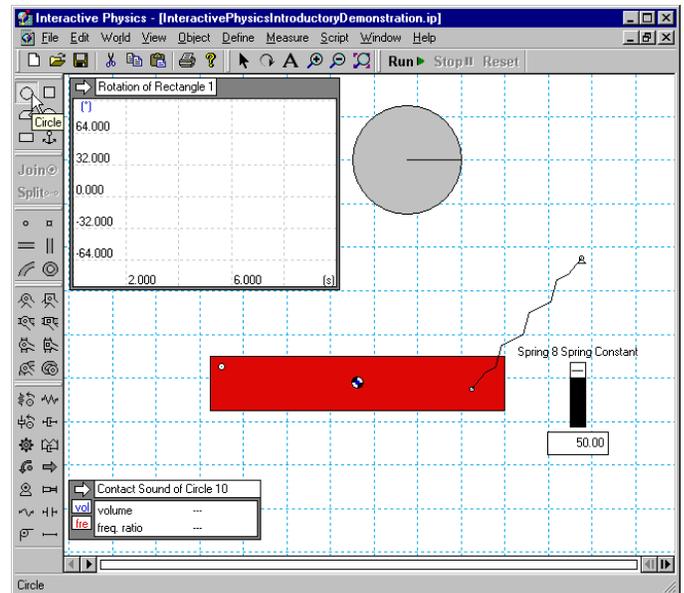
1.10 Controlling the Spring Constant

- To control the spring constant, select the spring. Under the Define menu, select New Control, then select Spring Constant.
- The slider that controls the spring will appear in the left-hand side of the workspace. To move the slider's location closer to the spring, click on the title and drag it next to the spring.
- To see the effect of varying the spring constant, click **Run** and observe that the equilibrium angle of the pendulum is a function of the spring-constant (move the slider up and down while the simulation is running).



1.11 Collisions with a Circle

- To create a circle, click on the Circle tool, then click in the workspace and draw a circle.
- Click **Run** to start the simulation and observe that the circle bounces and rolls on top of the rectangle. Automatic collision and contact is a very useful feature in Interactive Physics (even the elastic and frictional properties of objects may be varied). Click **Stop** and **Reset**.

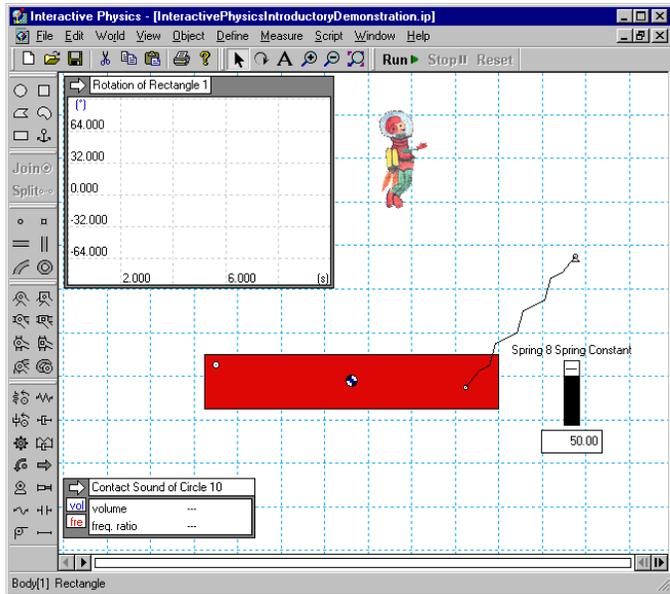


1.12 Attaching a Picture to an Object

- Using the Windows Explorer, go to the directory where Interactive Physics is installed, for example, D:\Program Files\IP 2000. Navigate to the sub-directory called Picture Library and then its sub-directory People.
- Double-click on the bitmap file "Spaceman.bmp." This should open the bitmap in a program such as Paint.
- In Paint, select Select All from the Edit menu to select the entire bitmap. Select Copy from the Edit menu to copy the bitmap to the Clipboard.
- Go back to Interactive Physics.
- Select Paste from the Edit menu to paste the spaceman image from the clipboard to the Interactive Physics workspace.
- To attach the spaceman bitmap to the circle, click and select the spaceman. Then hold down [Shift] while you click and select the circle.

Note: Interactive Physics was designed to be easy-to-use. In this exercise, the only time you need to touch the keyboard is to hold down the [Shift] key.

7. Select Attach Picture under the Object menu. Notice that the circle object has disappeared and has been replaced by the spaceman image.
8. Click **Run** to run the simulation. Click **Stop** and **Reset**.

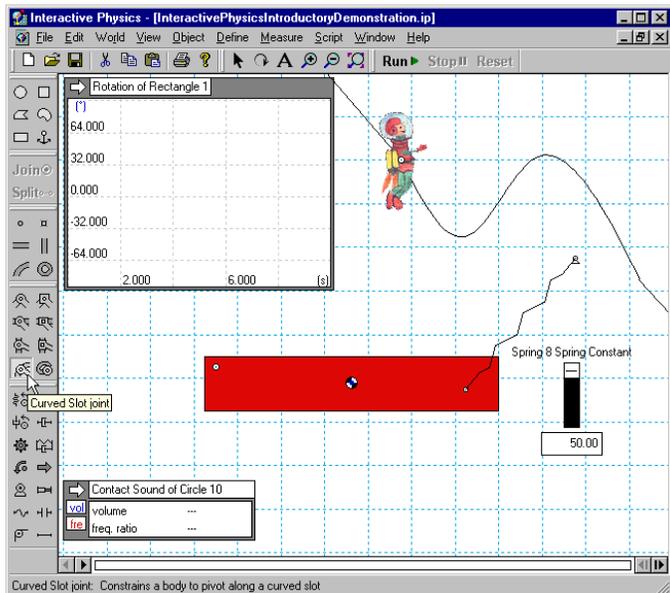


1.13 Adding Sound

1. To add sound, click on the spaceman and select Contact from the Measure menu.
2. Click **Run** to start the simulation to hear the sound when the spaceman contacts the block. Click **Stop** and **Reset**.

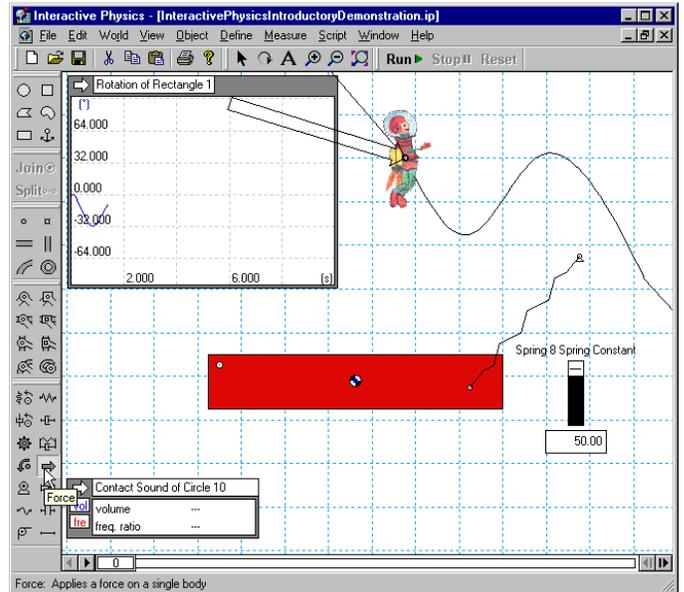
1.14 Adding a Curved Slot Joint

1. To add a Curved Slot Joint, click on the Curved Slot joint tool.
2. Click on the spaceman and then click on a couple of other places to the right of the spaceman, and then double-click to complete the slot.
3. Click **Run** to start the simulation and observe that the spaceman slide down the curved slot. Click **Stop** and **Reset**.



1.15 Adding a Force

1. To add thrust to the spaceman to overcome air resistance, click on the Force tool, then click on the spaceman, then move the mouse to the left and click again.
2. Click **Run** to start the simulation and observe that the spaceman is overcoming air resistance and is moving more quickly down the curved slot. Click **Stop** and **Reset**.



1.16 Running Demo Files

1. Under the Script menu, click on "Run All Demo Files".
2. Sit back and enjoy a series of demos on a variety of physics topics.

