

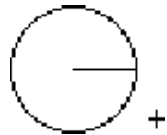
Step-by-Step

Creating and Running a Simulation With Interactive Physics

Using Interactive Physics, you can create simulations that represent real-life scenarios in physics. This Step-by-Step Card introduces you to Interactive Physics and identifies the most important tools you will use to create physics simulations.

Creating and placing objects

- 1** Open the Interactive Physics application.
- 2** To create an object, first select the appropriate tool from the toolbar on the left side of the screen. Drag to draw the object on your page.




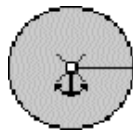
Tip: Some of the tools have small arrows in the lower-right side of their icon. These arrows indicate that other, similar tools are also available. To select those tools, select and hold the appropriate button (not the arrow), then choose the new tool. Other tools (if available) will pop up to the right.



Anchoring objects

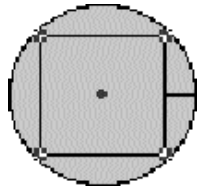
By default, worlds have gravitational force equivalent to that of Earth. As such, any objects that you place on your page will begin to fall as soon as you run your simulation. To affix objects in a particular place on your page, you should anchor them.




- 1 To anchor an object, select the Anchor tool  from the toolbar.
- 2 Click the object that you want to anchor. Some objects allow you to anchor them in several different locations. Consider how the location that you anchor might differ in different situations.

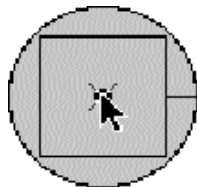


Using joints

- 1 To join multiple objects together, first drag one object over the other. Place the objects on top of each other so that they overlap on the screen.




- 2 Select a joint tool from the toolbar on the left side of the screen. A Pin Joint  joins two bodies with a hinge. A Rigid Joint  locks two bodies together. A Slot Joint  constrains a body to pivot along a slot.
- 3 Click the objects that you want to join at the location where you want to join them.



Using pulleys


Pulley systems can have multiple points, along with two endpoints. The force applied between each pair of points is equal. Each point in a pulley system can be connected to either the background or to a body.

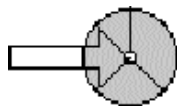
- 1 To create a pulley system, select the Pulley tool  on the toolbar.
- 2 Position the pointer in an empty area of the screen, then click to set the starting point.
- 3 Click again in a new location to create the first joint of the pulley. Double-click the last point or press any key on the keyboard to complete the pulley.



- 4 If you didn't attach them when you created the pulley, attach elements to the pulley by dragging a point on the pulley and releasing the mouse button at a point on an element.

Applying force to an object


- 1 To apply a force to an object, select the Force tool  on the toolbar.
- 2 Exert the force on an object by selecting a point on an object and dragging away from the direction that you want the force to apply. The longer you draw the arrow representing the force, the greater its magnitude.

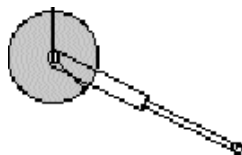


- 3 To manually set the magnitude of the force, first display the Properties window by choosing Properties from the Window menu.
- 4 Click the arrow representing the force you created to display properties for that element.
- 5 Enter the horizontal force (in Newtons) in the F_x text box in the Properties window. Enter the vertical force (in Newtons) in the F_y text box in the Properties window. Notice that the length and direction of the arrow representing your force change as you change the numbers in the Properties window.
- 6 Select other objects on your page and explore the characteristics that you can change using the Properties window.

Using an actuator

The Actuator tool creates an object that exerts a force between its endpoints. For example, an actuator simulates a piston used in a hydraulic lift. Actuators are attached to two bodies or to one body and the background. The endpoints of the actuator are the attachment points.

- 1 To create an actuator, select the Actuator tool  on the toolbar.
- 2 Position the pointer where you want to define the first endpoint (either the background or a point on an object). Click to create the first endpoint, then drag to the location where you want to place the second endpoint.






- 3 Select the actuator to reveal its properties in the Properties window. If the window is not visible, choose Properties from the Window menu.

The actuator is a multi-purpose constraint that exerts whatever force necessary to maintain its constraint specifications. You can specify its property in one of four ways: force, length, velocity, or acceleration.


- 4 To set the type of actuator, choose a type from the Type pop-up menu in the Properties window.
- 5 Enter the magnitude in the text box below the Type pop-up menu.

Running the simulation

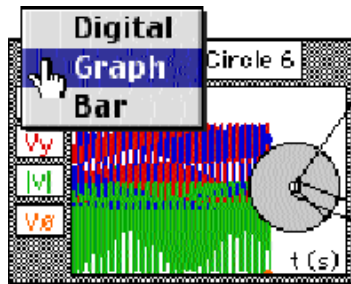
- 1 To run the simulation, click Run  in the upper-left corner of the window. The simulation begins to play.
- 2 Stop the simulation at any time by clicking Stop  in the upper-left corner of the window.
- 3 To reset the simulation, returning it back to the state at which it started, click Reset .

Measuring object parameters

Interactive Physics allows you to measure many physical properties including velocity, acceleration, and energy by using meters.

- 1 To create a velocity meter, first select an object that you want to measure (such as a circle). Choose Velocity from the Measure menu, then choose All from the submenu. By default, the meter displays number values of the object's velocity.
- 2 Click Run  to run the simulation. The meter displays numbers that quickly change as the object's velocity changes.

- 3 To change the display style of the meter, choose a new display style from the pop-up menu in the upper-left corner of the meter.



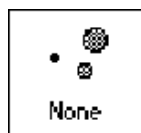
- 4 Click Stop to stop the simulation.
- 5 To remove the meter, select the meter on your page, then choose Clear from the Edit menu.
- 6 Explore other meters by selecting an object to measure on your page, then choose a meter from the Measure menu.

Changing gravitational forces

- 1 To change the gravitational force of a world, choose Gravity from the World menu.
- 2 Select the type of gravity that you want to apply: Vertical or Planetary.



- 3 Enter the magnitude of the gravitational force by entering it in the text box below the force type, or click the bar on the left side of the window to change the force.
- 4 To turn off all gravitational force, click None in the upper-left corner of the window.



- 5 Click OK.
- 6 Save the simulation.
- 7 Quit Interactive Physics.