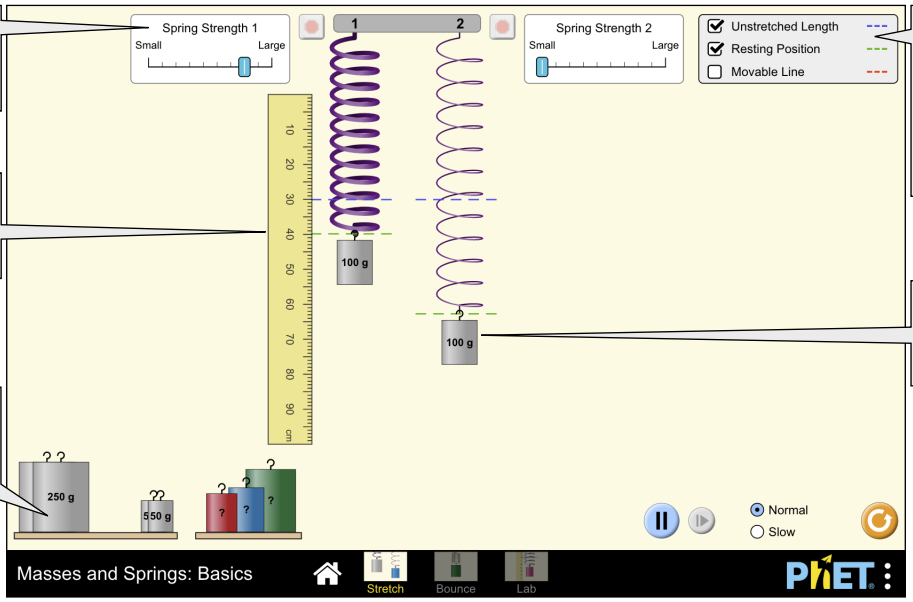
PhET Tips for Teachers

Masses and Springs: Basics

Stretch Screen

Play with one or two mass-spring systems and discover the relationship between the mass, spring constant, and displacement.



ADJUST the spring constant

MEASURE the displacement

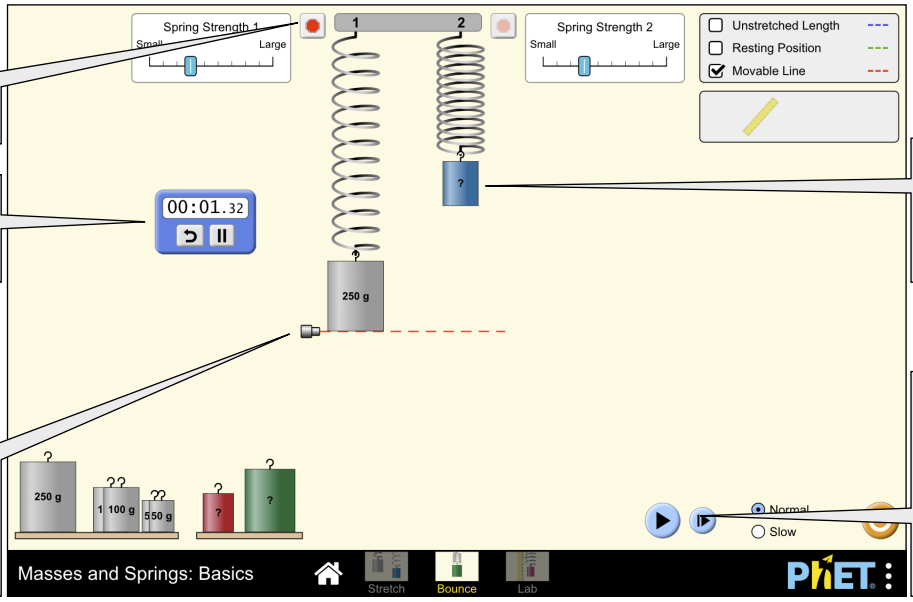
HANG masses from springs

VIEW natural length and equilibrium position

COMPARE two systems

Bounce Screen

Experiment with an oscillating spring, and determine which variables (such as mass, spring constant, or displacement) affect the period.



STOP oscillation

MEASURE the period

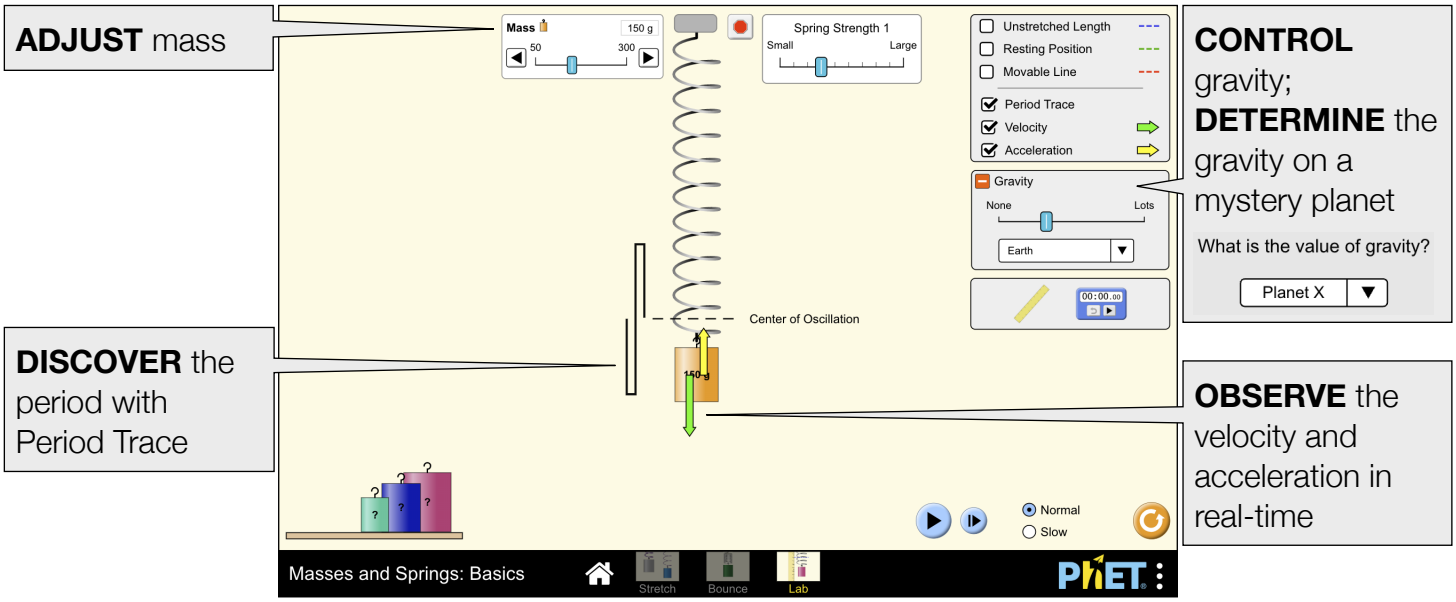
SET reference point with Movable Line

EXPERIMENT with mystery masses

PAUSE the sim to set up an experiment; **JUMP** forward by 0.01 seconds

Lab Screen

Collect data and determine the value of the mystery mass or g on Planet X.



Suggestions for Use

Sample Challenge Prompts

- Describe the Unstretched Length and Resting Position in your own words.
- Identify all the ways to increase the displacement at equilibrium.
- Determine the relationship between the applied force and displacement.
- Explain what the period represents, and determine a method to measure it.
- Design a controlled experiment to (qualitatively or qualitatively) determine how a variable — such as mass, gravity, spring constant, or displacement — affects the period.
- Determine a way to give a heavier mass a shorter period than a lighter mass.
- Determine the mass of the mystery masses or the value of g on Planet X (qualitatively or quantitatively), and explain your method(s).

Customization Options

Query parameters allow for customization of the simulation, and can be added by appending a '`?`' to the sim URL, and separating each query parameter with a '`&`'. The general URL pattern is:
`…html?queryParameter1&queryParameter2&queryParameter3`

For example, in Masses and Springs: Basics, if you only want to include the 1st and 2nd screens (`screens=1,2`), with the 2nd screen open by default (`initialScreen=2`) use:
https://phet.colorado.edu/sims/html/masses-and-springs-basics/latest/masses-and-springs-basics_all.html?screens=1,2&initialScreen=2

To run this in Spanish (`locale=es`), the URL would become:
https://phet.colorado.edu/sims/html/masses-and-springs-basics/latest/masses-and-springs-basics_all.html?locale=es&screens=1,2&initialScreen=2

Query Parameter and Description	Example Links

`screens` - specifies which screens are included in the sim and their order. Each screen should be separated by a comma. For more information, visit the Help Center.	`screens=1`
	
	`screens=2,1`

`initialScreen` - opens the sim directly to the specified screen, bypassing the home screen.	`initialScreen=1` `initialScreen=3`
`locale` - specify the language of the simulation using ISO 639-1 codes. Available locales can be found on the simulation page on the Translations tab. Note: this only works if the simulation URL ends in "_all.html".	`locale=es` (Spanish) `locale=fr` (French)
`allowLinks` - when `false`, disables links that take students to an external URL. Default is `true`.	`allowLinks=false`

Model Simplifications

- The thickness of the spring is used to indicate the spring constant. The spring constant range is 3-12 N/m, with tick mark intervals of 1 N/m.
- The gravity values for the planets/moon match those used in the original Masses and Springs simulation. (Earth = 9.8 m/s^2, Moon = 1.6 m/s^2, Jupiter = 24.8 m/s^2)
- The vocabulary in this simulation is designed for younger learners who many not have been formally introduced a mass-spring system or simple harmonic oscillation.
    - Spring Strength: spring constant
    - Unstretched Length: natural length
    - Resting Position: equilibrium position
- On the Stretch Screen, the springs are heavily damped to minimize oscillation. This is to better support learning goals related to Hooke's Law. However, the springs on the Bounce and Lab screens are undamped. To support learning goals around damping, please use Masses and Springs.
- On the Lab screen, turning on the Period Trace, Velocity, or Acceleration will reveal the "Center of Oscillation" line, which represents the location of the center of mass at equilibrium. The Period Trace, Velocity, and Acceleration are drawn with respect to the center of mass, so the Center of Oscillation is a more appropriate reference than the Resting Position (equilibrium position).
- The Period Trace draws the path of one full oscillation about the equilibrium position of the center of mass. The path will begin drawing when the center of mass crosses the Center of Oscillation line.
- If a parameter (e.g. gravity, mass) is changed mid-oscillation, the instantaneous displacement, mass, spring constant, gravity, and velocity will be used as the new initial conditions for the equation of motion. Frequent mid-oscillation changes can lead to hard-to-interpret (though technically still accurate) behavior, so we recommend stopping the mass between experiments.

See all published activities for Masses and Springs: Basics here.
For more tips on using PhET sims with your students, see Tips for Using PhET.