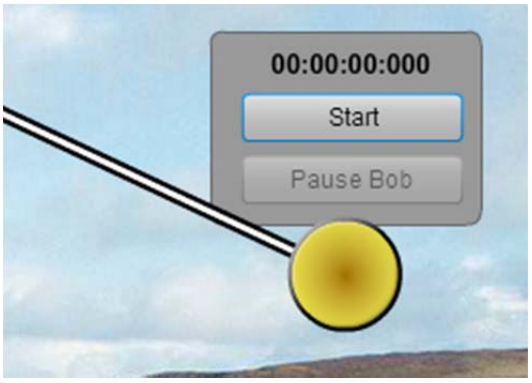
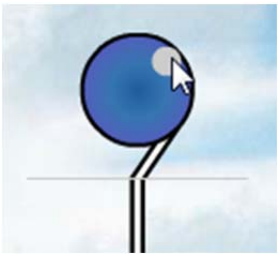
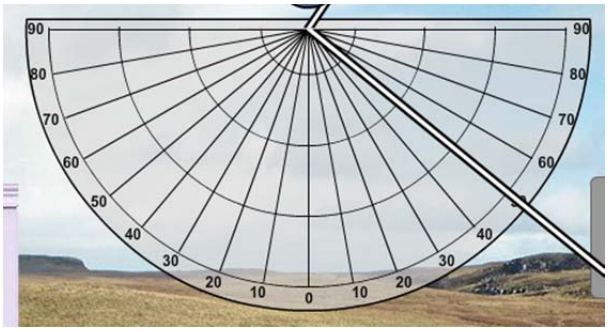
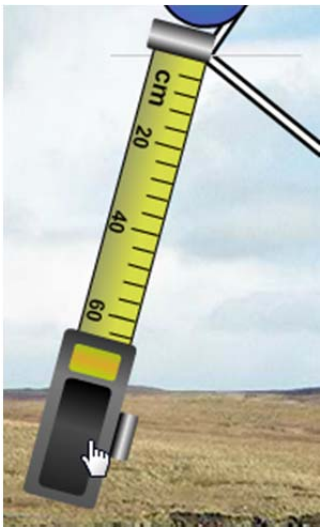
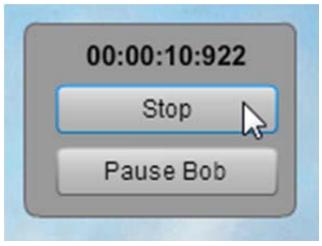
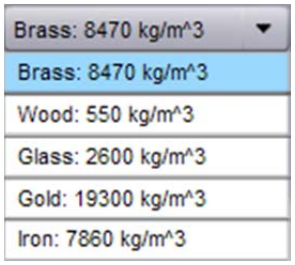
1 – The Simple Pendulum User's Guide:	1/30/2025
The pendulum bob. A spherical bob is attached to the end of an adjustable string. To move the bob to the chosen starting position, click, drag, and release it at the desired position. It will remain at that point until released by the Start button.	
The spool. The upper end of the string passes through a slit and the attaches to a spool. The slit provides a stationary top end for the swinging pendulum. Clicking on the light blue handle on the spool and dragging it in a circular manner will reel the string in or out as needed to adjust the length of the pendulum.	
The protractor. A protractor is used for measuring the amplitude (angle) of the pendulum. Clicking the check box beside 'Protractor' will attach or detach the protractor as needed.	 

The measuring tape. A measuring tape is used for measuring the length of the pendulum. Clicking the check box beside ‘Measuring Tape’ will attach or detach the measuring tape as needed. Dragging the body of the measuring tape will adjust its length. **Important note:** The tape can be rotated to move it out of the way but it should only be used for measurement when the pendulum is in a vertical position. Clicking the small blue handle on the spool will move the pendulum to a vertical orientation. Initially, when the door is present, the tape is calibrated in centimeters. When the screen scale is changed by replacing the door with the monument or lady bug, the units on the tape are changed to meters, and mm respectively. (See scaling object for more on this.)	 
The stopwatch. As the bob is dragged to its desired starting point, a stopwatch travels along with it. The stopwatch times and controls the motion of the pendulum. The Start/Stop button starts and stops the timer. It also releases the bob but **does not** stop the bob when the timer is stopped. Typically you’d measure the time for say, 10 full swings and then stop the timer and divide the elapsed time by 10 to determine the period. The Pause Bob/Unpause Bob button controls the bob and the timer, essentially freezing/unfreezing time. This has various uses. You can pause the bob to take a time reading and then unpause it to let the timer and bob continue from the conditions when they were paused. And because the bob continues its motion when unpaused you can stop it during a discussion of its motion at various points and then let it continue with its motion. A good example would be during the study of mechanical energy.	
Drag. By default the pendulum behaves as if in a vacuum. That is, there is no air resistance. The ‘no drag — some drag’ tool allows for the addition of an adjustable drag force. This is currently a very crude drag force in that it does not vary with the speed of the bob.	

The bob mass. To allow for observing the effect of the mass of the bob, bobs of five different materials (densities) are provided. The bob is initially made of brass, but the pull down density selector provides bobs made of wood, glass, gold, and iron. You may notice that the bobs don't look spherical. Making the bobs look spherical actually slows down the operation of the lab. It runs at 60 frames per second. That is, the bob's location is recalculated and refreshed 60 times a second. The realism that this provides would be diminished with bobs made to look spherical. The mass of the bob is calculated by measuring its diameter with the tape, calculating its volume, and then using the density to determine its mass. The reason the masses are not provided is due to the use of different screen scales as discussed in the scaling object section. When the screen scale changes, the mass of the bob also changes. Incidentally, be sure to calculate the price of the gold bob at current market rates. This is one expensive piece of equipment!	
The screen scale. What is the door for? To allow for a larger range of bob lengths three different screen scales are provided. Initially the screen should be visualized as a bit taller than a standard door. Thus the door is used as a scale reference object. The measuring tape is calibrated in centimeters and the door appears to be about 200 cm tall. Thus we're working with the sort of pendulum that you'd likely use in a classroom. The screen scale pull down menu provides two other choices. The choice of 'Monumental' replaces the door with the Washington Monument. The tape changes to meters and we see that the monument is about 170 m tall. (555 feet 5 1/8 inches (pre-earthquake)) The pendulum's period changes appropriately. The third choice, 'bug' uses a ladybug as a reference object and the ruler changes to millimeter units. This tiny pendulum's period is too short to measure. Note also that the bob's mass is tiny to at this scale.	

The local gravitation. What good is a pendulum that's so short? The final variable, the local gravitation, lets you take the pendulum, the door, the monument, and the bug, to the moon and then to the asteroid 'Brian.' In the lab activity accompanying this lab the students are led through the derivation of the equation for the period of a pendulum in terms of length and the acceleration due to gravity, g. After they have this equation they can find the value of g on the moon and compare it to what they find in a book, on the Internet, etc. They can then try the same on 'Brian' (not the actual name. The actual asteroid information is in the teacher's edition of the lab. Brian was the creator of this lab.) This becomes the unknown for the lab. This is also a good time to discuss how g is found on the moon, how this is related to prospecting for gas and minerals, etc. It's also interesting to discuss g on a non-spherical body such as Brian.