

## 6 – Torque User’s Guide:

06/10/2014

**The lever.** The pivot position on the lever can be changed by clicking and dragging on either the wooden base or the pivot itself. The base can be moved left or right to the edge of either end of the lever.



**The buttons.** The lever starts out in a paused state of existence. No matter what is applied, it holds steady until the student chooses to release it and let physics take control. The “Release Beam” button acts as this unpause button. If the system is not in equilibrium, the lever will tip to one side or the other. The “Reset Beam” button will bring the system back to a level state and pause it again until released. If there are masses attached to the system, the “Reset Masses” button will remove them but will leave the rest of the experiment unchanged. For a complete reboot, “Reset All” will remove all tools and bring the system back to its starting position.



**The clamps.** The yellow and gray clamps are the means for adding masses, balloons, or both to the lever. To add a clamp, click and drag until it is over the meter stick and then let go to drop. If a clamp is released onto another clamp it will fly back to its corner position.

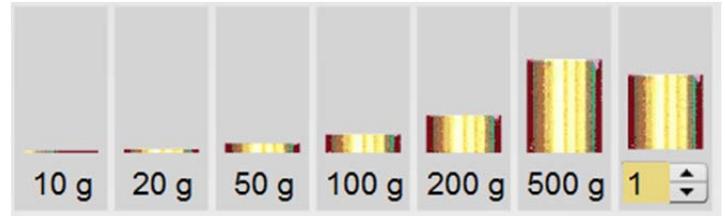
Once on the lever, the clamp can be moved left to right by clicking and dragging on the bottom gray half of the clamp. To move the clamp freely in space, click and drag the yellow half. To remove a clamp from the lever, click and drag the yellow half and release it anywhere other than the meter stick. The clamp and anything attached to it will return to their home spaces.



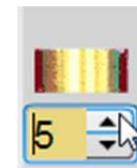
**The hangers.** Once a clamp is attached to the lever, a mass hanger can be added by clicking and dragging one to the clamp and releasing. To remove, simply click and drag away from the clamp.



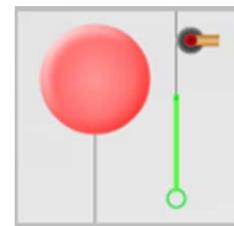
**The masses.** A range of brass masses can be added to a hanger by clicking and dragging in a similar fashion. Additional masses can be added until the hanger is at maximum capacity. To remove masses, right-click a hanger and select "Remove Top Mass" or press the "Reset Masses" button to remove all masses.



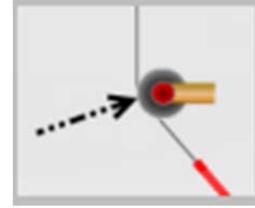
**Unknown mass.** The right-most mass is an unknown mass with ten possible values. The choice of #1-10 is made using the numeric stepper below the mass. The mass changes height according to its mass. The choice must be made before adding the mass to a mass hanger.



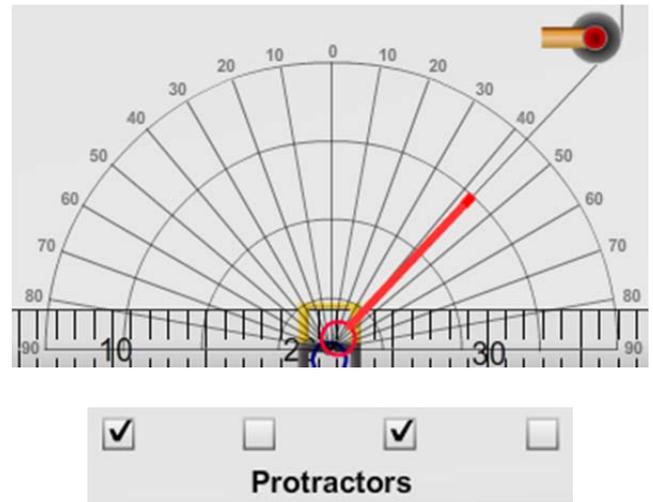
**The balloons.** Add balloons by click and dragging them to clamps on the lever. The buoyancy of each balloon is displayed below the blue line in the center of the screen. The buoyancy of the balloons can be adjusted using the up and down arrows next to the value or by typing in a number into the box. The acceptable range for this value is from 10 to 500.



**The pulleys.** The angles of each balloon on the lever can be adjusted by clicking and dragging on an orange pulley. At the center of each pulley there is also a button that is red by default. When the button is red, moving the clamp will move everything connected including the balloon and pulley, keeping the angle constant. If the button is clicked and changed to blue, the pulley and balloon will then be locked in space the clamp will move independently, which will change the angle of the balloon force. This part is tricky and may take some getting used to but it will give the student more options for adjustments.



**The protractors.** With a balloon attached, a protractor can be displayed by clicking on the box below that particular balloon's buoyancy. Each balloon's protractor can be turned on or off independently.



**Auto-Release.** To keep the system in active mode and to bypass the "Release Lever" button, click the box next to "Auto-Release." With this box checked, the system will automatically respond to any changes made.



**Massless Clamps.** To make the clamps massless in order to focus on just the actual masses and hangers, click the box next to "Massless Clamps." With this box checked, the system will treat the hangers as if they have zero mass.



**Lever Arm Tool.** To use a measuring tape that extends from the base point of the beam (useful for measuring balloon distances), click the box next to “Lever Arm Tool.” When it appears, click and drag it out as needed. It can be moved but will always re-snap to the base.

Lever Arm Tool

