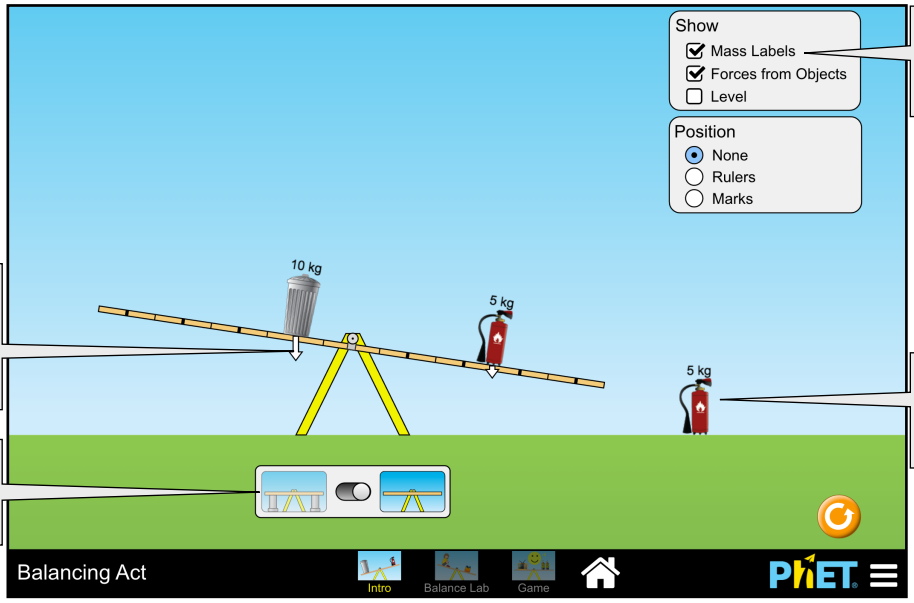
PhET Tips for Teachers

Balancing Act

Intro Screen

Play with objects on a teeter totter to learn about balance.



SEE the masses of the objects

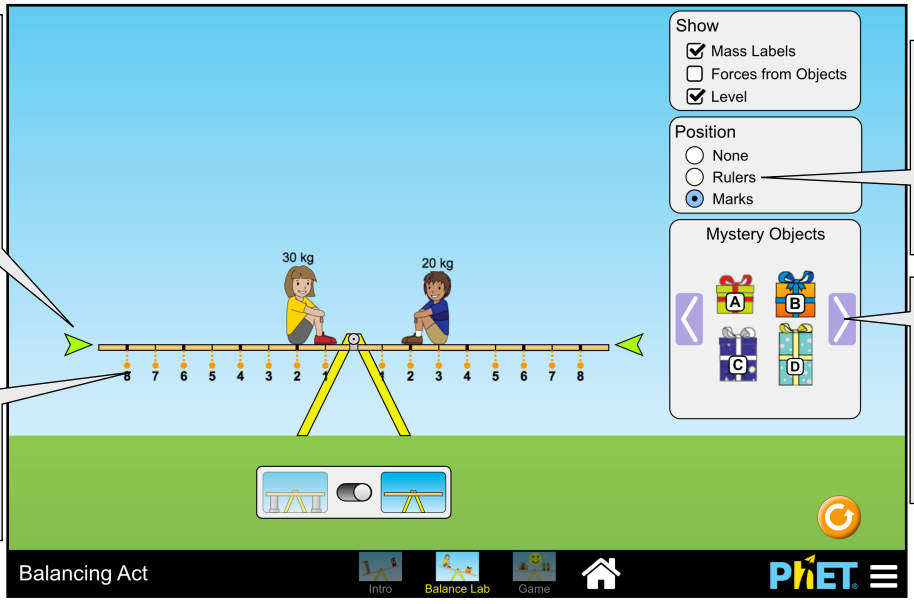
DISPLAY the forces in the system

DRAG items onto the plank

REMOVE supports

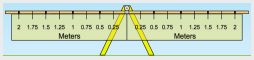
Balance Lab Screen

Explore how to balance the plank using various objects, and determine the masses of mystery objects.



OBSERVE if level (green arrow) or not (gray arrow)

MEASURE the distance from the fulcrum



USE marks to determine distance

SELECT bricks, people, or mystery objects with an unknown mass

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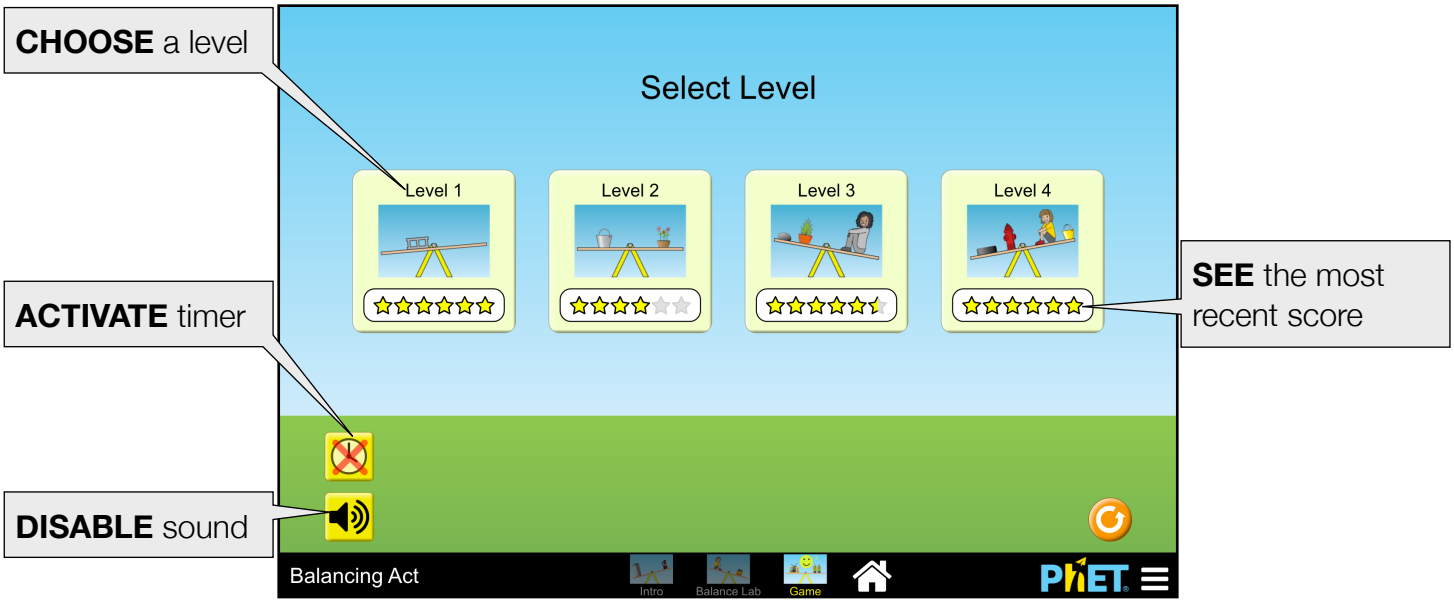
Game Screen

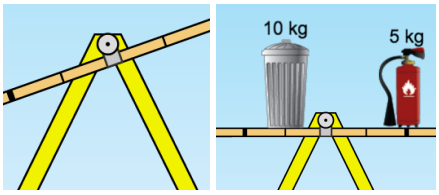
Solve puzzles about balancing — add an object to balance the plank, predict the direction the plank will move when the supports are removed, or determine the mass of an unknown object. As the level increases, the challenges become more difficult.



Insights into Student Use

- Middle school students tend to put many objects on the board. The Intro Screen was added to help simplify the investigation. It may be helpful to have a discussion about how position of a heavy object can be used to balance a light one.
- The games are provided to help students build skills, some students toggle back to the first screen to test their ideas and this seems helpful.

Model Simplification



- The pivot point is slightly vertically offset from the center of mass of the plank. This was done so that if the plank is in an unbalanced situation (left) and then the student makes the total torque zero (right), the plank will level. In a centered pivot situation, a zero torque would not cause motion.
- Object mass is considered to be centered and in the plank; the white line below the object shows the location.
- The Mystery Objects have varying mass which is not related to the size. We have refrained from publishing the masses, upon the request of teachers.
- The Force vectors are shown as initiating at the base of the objects instead of from center of mass to help beginning students build their own ideas easily.

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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 Balancing Act, 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/balancing-act/latest/balancing-act_all.html?screens=1,2&initialScreen=2

To run this in Spanish (locale=es), the URL would become:
https://phet.colorado.edu/sims/html/balancing-act/latest/balancing-act_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

Suggestions for Use

Challenge Prompts

- Balance two objects with unequal masses.
- Predict how adding an object (or repositioning an object) will affect the motion of the plank.
- Design an experiment to determine the mass of a mystery object.
- Create a general rule to describe how the plank will tilt.

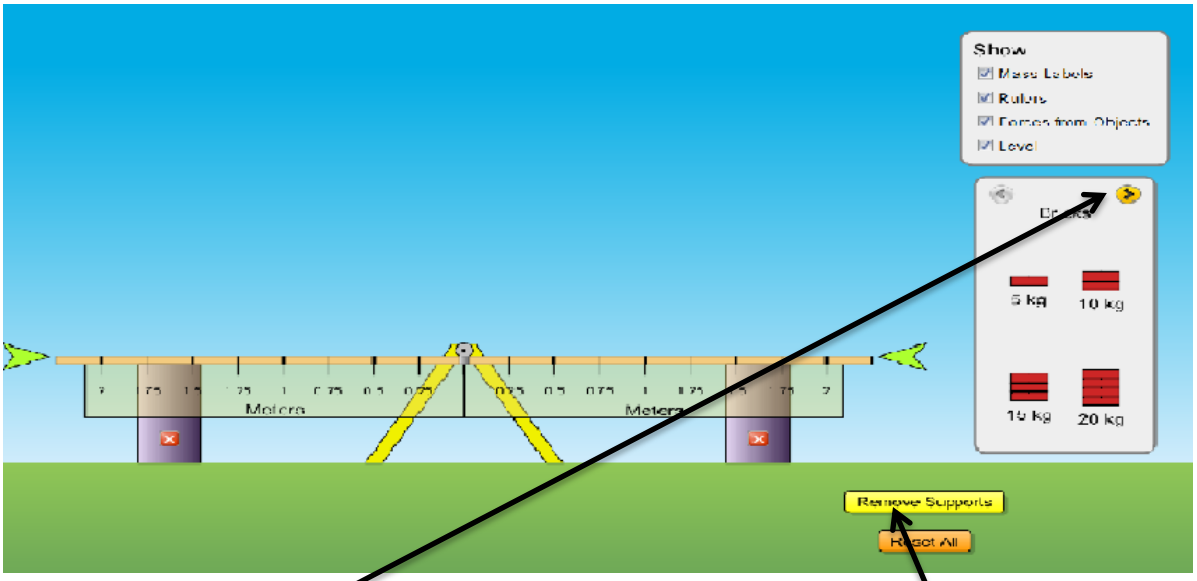
See all published activities for Balancing Act here.
For more tips on using PhET sims with your students, see Tips for Using PhET.

Name_____ Period_____

CP Physics – Mrs. Carpinelli Date_____

ROTATIONAL EQUILIBRIUM SIMULATION ASSIGNMENT

DIRECTIONS: For this activity, you will be using the pHet website http://phet.colorado.edu/sims/html/balancing-act/latest/balancing-act_en.html (linked on my website). When you open it, select the "Balance Lab" tab and select "Mass Labels", "Rulers", "Forces from Objects" and "Level" under the "Show" box. Your screen should look like this one:



Notice the yellow arrow above the word "Bricks" in the second box. Click this arrow. You will see other objects (like people and mystery packages) that you will use for various parts of this activity. For now, we will use the bricks. Also notice the "Remove Supports" button. We will use this button frequently. Click this button now. Does anything happen?

PART A. ROTATIONAL EQUILIBRIUM CONDITIONS.

Select the 5 kg brick and place it 0.25 m from the center of rotation (called the fulcrum). Place another 5 kg brick at the opposite 0.25 m position. Remove the supports. *Does the seesaw move? Why/why not?*

Put the supports back. Now move one of the 5 kg bricks to the 0.5 m position. Remove the supports again. *Does the seesaw move? Why/why not?*

Move the same 5 kg brick to the 1.0 m position. *How does the position of the seesaw compare to its position when the brick was at the 0.5 m position? Why is this the case?*

Put the supports back in place and remove one of the 5 kg bricks. Place the other at the 0.25 m mark and then add a 10 kg brick to the 0.25 m mark on the other side. Remove the supports. *Does the seesaw move? Why/why not?*

Replace the 10 kg brick with a 20 kg brick. *How is the motion of the seesaw affected? Why does this happen?*

What does it mean to be in a state of rotational equilibrium?

PART B. SIMPLE ROTATIONAL EQUILIBRIUM.

In this part of the activity, you will be placing objects at various positions to balance the seesaw. You will be told a starting mass (brick or person) and position and then will determine where a second mass should be placed in order to balance it out. To do this, you will be required to do a torque summation. The first one has been done as an example. Check your answer by placing the objects on the seesaw and removing the supports.

Name_____ Period_____

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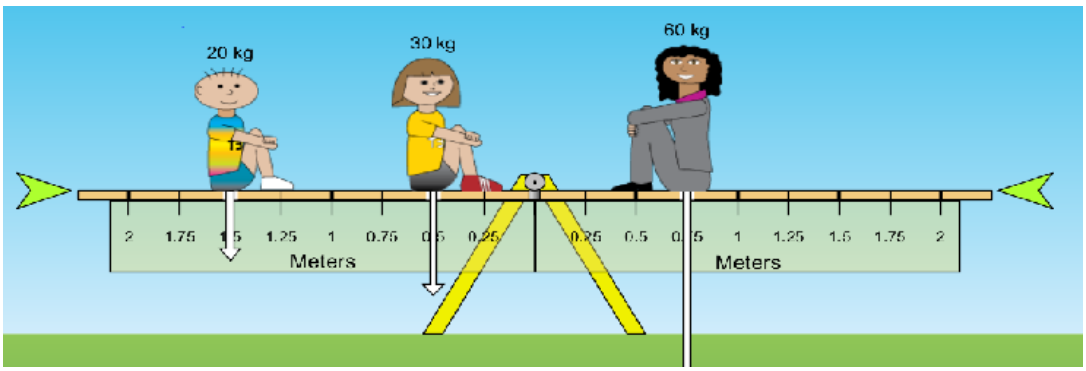
Mass 1 (kg)	Position 1 (m)	$\tau_{Right} = \tau_{Left}$	Mass 2 (kg)	Position 2 (m)
20	0.5	(20)(9.8)(.5) = (5)(9.8)x *x = 2.0*	5	*2.0*
20	1.0		10	
80	0.25		20	
30	0.5		10	
10	1.0		20	
5	2.0		20	
15	1.0		60	

PART C. COMPLEX ROTATIONAL EQUILIBRIUM.

For this part you will be working with situations with multiple objects on the same side of the fulcrum. For example:



Name_____ Period_____
CP Physics – Mrs. Carpinelli Date_____

Mass 1 (kg)	Position 1 (m)	Mass 2 (kg)	Position 2 (m)	$\tau_{Right} = \tau_{Left}$	Mass 3 (kg)	Position 3 (m)
20	1.5 m Left	30	0.50 m Left	(20)(9.8)(1.5) + (30)(9.8)(0.5) = (60)(9.8)x *x = 0.75*	60	*0.75 m Right*
20	1.0 m Left	60	2.0 m Left		80	
80	1.5 m Left	30	0.5 m Right		60	
60	1.0 m Left	80	0.25 m Right		20	

PART D. MYSTERY PACKAGES.

For this part, you will determine the masses of the mystery packages based on known objects and distances.

Name_____ Period_____

CP Physics – Mrs. Carpinelli Date_____

Known Mass 1 (kg)	Position 1 (m) Left	$\tau_{Right} = \tau_{Left}$	Mystery Package	Position (m) Right	Mass of Package (kg)
60	0.5	(60)(9.8)(0.5) = (x)(9.8)(1.5) *x = 20*	A	1.5	*20*
30	1.0		C	2.0	
30	0.25		D	.75	
60	0.25		H	2.0	

Known Mass 1 (kg)	Position 1 (m)	Known Mass 2 (kg)	Position 2 (m)	$\tau_{Right} = \tau_{Left}$	Mystery Package	Position (m)	Mass of Package (kg)
20	1.75 m Left	80	0.5 m Left		F	1.5 m Right	
60	0.5 m Left	15	1.75 m Right		E	1.25 m Right	
20	0.25 m Left	5	1.0 m Left		B	2.0 m Right	

If you are trying to balance a seesaw and you have a higher mass on the left, should the mass on the right be placed at a greater distance or lower distance to balance it? Why?