Balancing Act At-Home Exercises

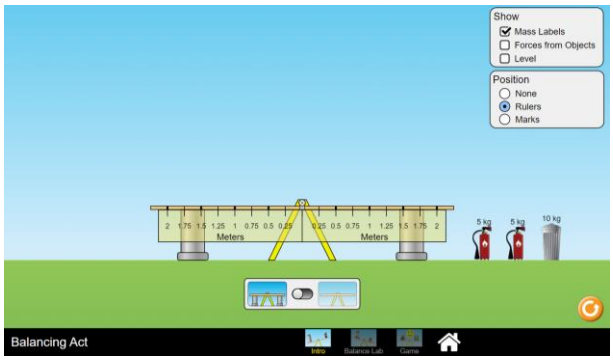
This lab uses the **Balancing Act** simulation from PhET Interactive Simulations at University of Colorado Boulder, under the CC-BY 4.0 license.

https://phet.colorado.edu/sims/html/balancing-act/latest/balancing-act_en.html

Learning Goals: Students will be able to:

1. Describe the factors that determine whether two objects will balance each other
2. Predict how changing the position of a mass on the balance will affect the motion of the balance
3. Use a balance to the find the masses of unknown objects
4. Apply mathematics to calculate the position of a mass that will balance another mass on the other side of the balance

Develop your understanding: Explore the ***Intro*** page to develop your own ideas about what determines how objects balance each other. Turn the "Mass Labels" on and the "Rulers" position on.



1. Make two objects of the **same mass** balance in at least two different ways.

    a. Explain to yourself why it makes sense that there is more than one way to make the objects balance.

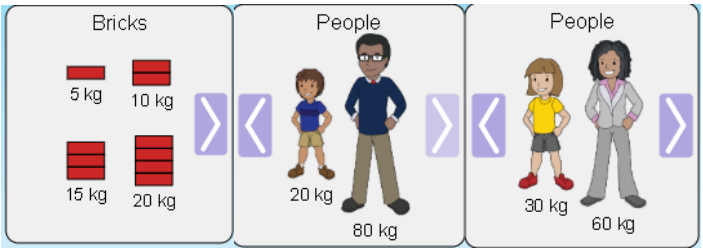
    b. What tools did you use to help you and why did they help?

2. Make two objects of **different mass** balance in at least two different ways.

    a. Explain to yourself why it makes sense that there is more than one way to make the objects balance.

    b. What tools did you use to help you and why did they help?

Test your understanding: Open the ***Balance Lab*** page, use some different objects and masses to apply your ideas. RECORD YOUR ANSWERS! We will go over these in the next class



3. Place the 60 kg woman at 0.5 m.
    a. Place the 30 kg girl on the balance. Where must she sit to balance the woman? Why?

    b. Place the 20 kg boy on the balance. Where must he sit to balance the woman? Why?

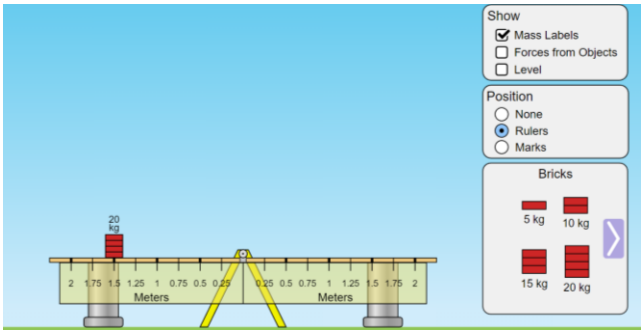
    c. Select any three mystery objects and determine each mass. You may move the location of the 60 kg woman if you need to. NOTE: the masses of e though h are "trickier" to find and a through d are easier. Not all of these can be found using the 60 kg woman. If you want to find the masses of all of them for fun, you may need to use different masses.

4. Find two different ways that the 60 kg woman can balance the 80 kg man. Both the man and the woman can be moved to any location on the level.
    a. Can you find a way in which the 60 kg woman is further away from the center of the balance than the 80 kg man? Why or why not?

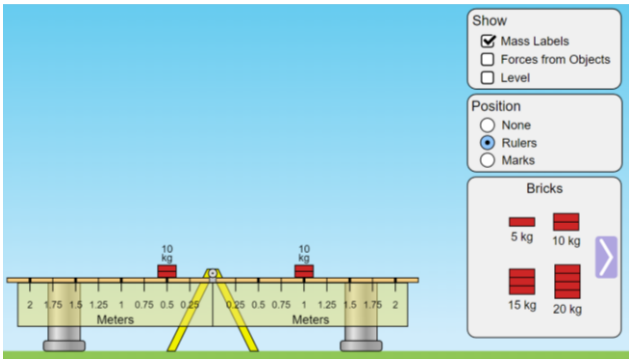
Apply your mathematics: Open the ***Balance Lab*** screen, use some different objects and masses to apply your ideas.

Remember: when you add up the mass times the distance from the center of each object on the left that sum must equal the mass times the distance from the center of each object on the right.

5. With a 20 kg mass at 1.5 m, <u>write an equation</u> that tells you where a 15 kg mass must be placed to keep the balance level.



6. With the 10 kg mass at 0.5 m on the left and the 10 kg mass at 1 m on the right, <u>write an equation</u> that tells you where a 5 kg mass must be placed to keep the balance level.



Balancing Act Game

Test your understanding and use the rules you have developed:
Open the full simulation **Balancing Act**, then open the **Game** screen.

1. Play Level 1

    a. When you complete the level 1 game, make a note of your score out of 12.

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2. Play Level 2

    a. When you complete the level, make a note of your score.

3. Play Level 3
    a. When you complete the level, make a note of your score.

4. Play Level 4
    a. When you complete the level, make a note of your score.

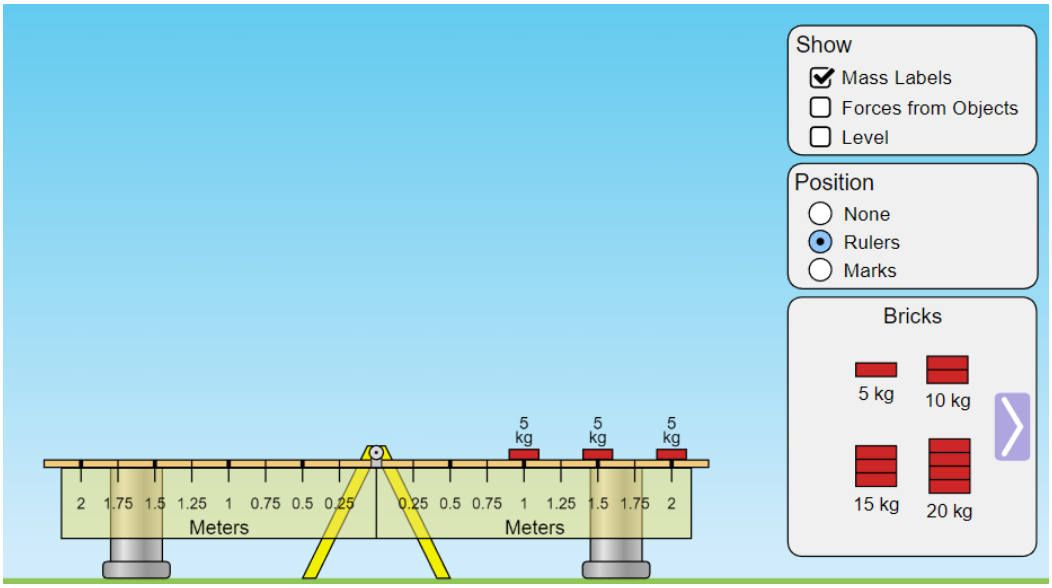
Final Score:
After you play all levels of the game, add all of your scores from the four levels. You will turn in this score at the next class.

Extra challenge: For an extra challenge, you can turn on the timer  and see if you can improve your skills.

Difficult At-Home Exercises

Applying everything you have learned, including the use of mathematics, attempt to answer these questions. We will go over these in class as well.

Set up the balance as shown.



1. Find a way in which the balance can be leveled with only ONE of the 4 bricks (5 kg, 10 kg, 15 kg, or 20 kg). NOTE: there may be more than one way to accomplish this.

2. Find a way in which the balance can be leveled with TWO bricks of DIFFERENT mass. NOTE: there may be more than one way to accomplish this.

3. Find a way in which the balance can be leveled with THREE bricks, TWO of which have the SAME mass and the third a different mass. NOTE: there may be more than one way to accomplish this.

4. Find a way in which the balance can be leveled with THREE bricks of DIFFERENT mass. NOTE: there may be more than one way to accomplish this.