The Rule of Balance

Purpose: **http://www.physicsclassroom.com/Physics-Interactives/Balance-and-Rotation/Balance-Beam/Balance-Beam-Interactive**

To determine the *rule of balance* that helps one to predict the required amount of weight and its placement relative to the fulcrum in order to balance a weight on the opposite side of the fulcrum and a known distance away.

Background:

A balance beam consists of a long board or *beam* and a fulcrum from which or upon which it rests. If a weight is placed upon the balanced beam, then the weight will exert a force on the beam and cause it to rotate about its fulcrum. This is known as a **torque** - the tendency of a force to cause a rotation of the beam. Torques can cause the beam to rotate clockwise or counter-clockwise about the fulcrum. In this simulation, you will experiment with the placement of various masses (or weights) upon the beam and their distance from the fulcrum in an effort to balance the beam. By investigating this concept of balanced torques, you will discover the *rule of balance*.

Getting Ready:

Navigate to the Balance Beam simulation in the Physics Interactives section.

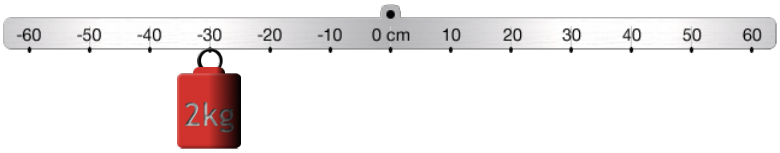
www.physicsclassroom.com => Physics Interactives => Rotation and Balance => Balance Beam

Once at the proper page, Launch the Interactive and begin working through the Data section below.

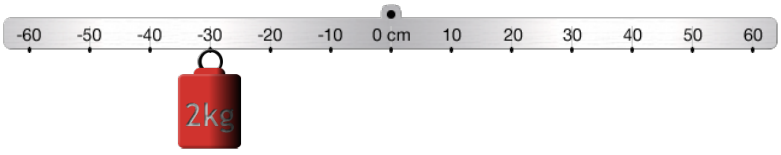
Directions:

Complete the following sentences. Draw the location of the masses on the diagram. **Show your work.**

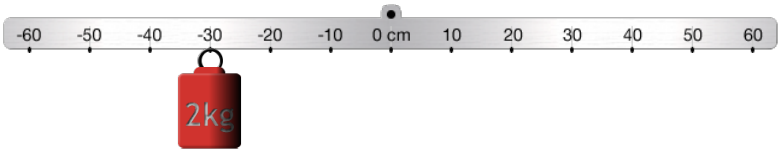
1. A **2-kg** mass placed **30-cm** to the left of the fulcrum is balanced by a **2-kg** mass placed _____ cm to the right of the fulcrum.



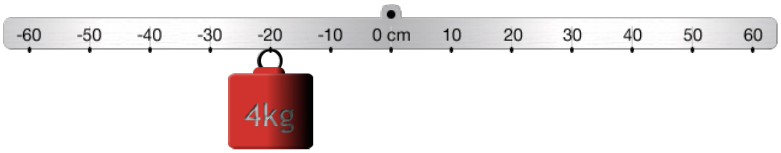
2. A **2-kg** mass placed **30-cm** to the left of the fulcrum is balanced by a **1-kg** mass placed _____ cm to the right of the fulcrum.



3. A **2-kg** mass placed **30-cm** to the left of the fulcrum is balanced by a **3-kg** mass placed _____ cm to the right of the fulcrum.

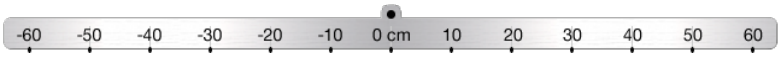


4. A **4-kg** mass placed **20-cm** to the left of the fulcrum is balanced by a **2-kg** mass placed _____ cm to the right of the fulcrum.

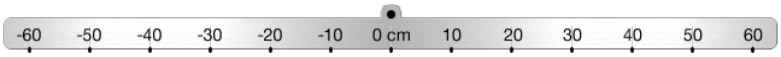


For **Questions #5-#7**: Show the locations where the listed masses must be placed to achieve balance.

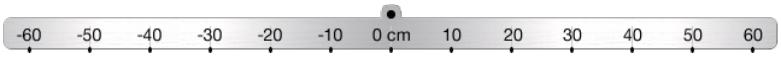
5. **1-kg** vs. **3-kg**:



6. **1-kg** and **2-kg** (left side) vs. **4-kg** (right side)

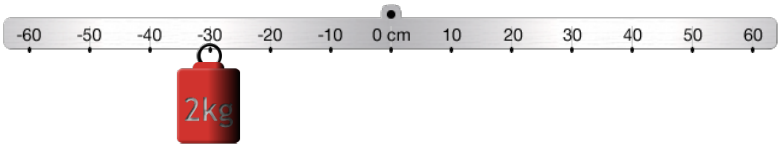


7. **1-kg** and **2-kg** (left side) vs. **3-kg** (right side)

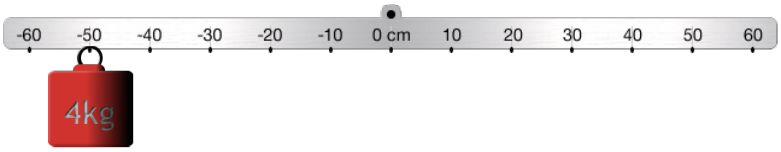


For **Questions #8-#9**: Show where the *unplaced masses* could be placed in order to achieve balance.

8. **3-kg** and **3-kg**



9. **1-kg** and **3-kg**



10. Determine the amount of mass possessed by the blue mass. Show your data and explain your reasoning or show the math.

Conclusion:

On a separate sheet of paper, make a **claim** in which you mathematically state the *rule of balance* - that is, the rule that one must use to determine if two weights placed on opposite sides of the fulcrum will balance each other. Then use one result from Q#1-4 and one result from Q#6-9 as evidence in support of your claim. For each question you select to discuss, thoroughly explain with solid **reasoning** how the data serve as **evidence** in support of your claim.