

During this interactive you are going to investigate torque. You will do this by looking at systems where torque is balanced (The net torque is zero).

1. Define Torque.

Part 1:

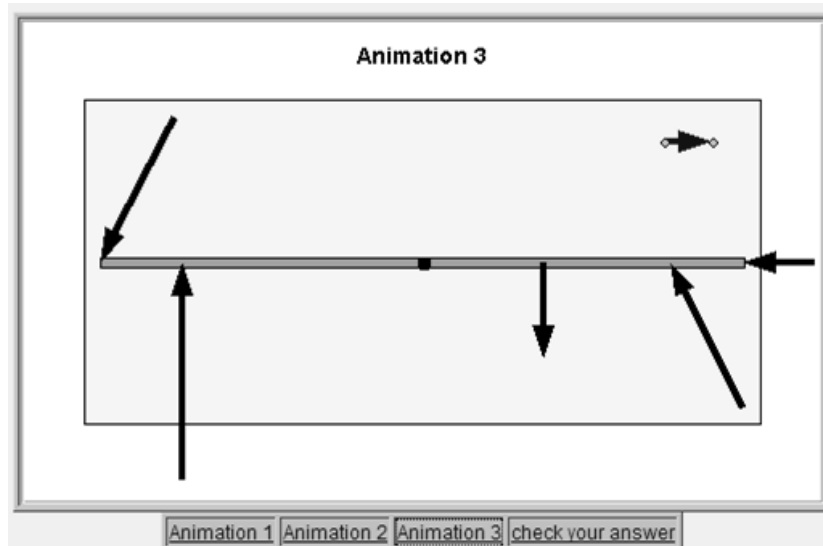
You are investigating the torque and forces on a bar that is laying on a frictionless horizontal surface. Your view point is from above. Since the weight and normal force cancel each other out and are not shown; they are into and out of the page, respectively.

Open the shortcut “IL Torque” on one of the lab stations.

Do Not follow the directions in the simulation follow these instructions.

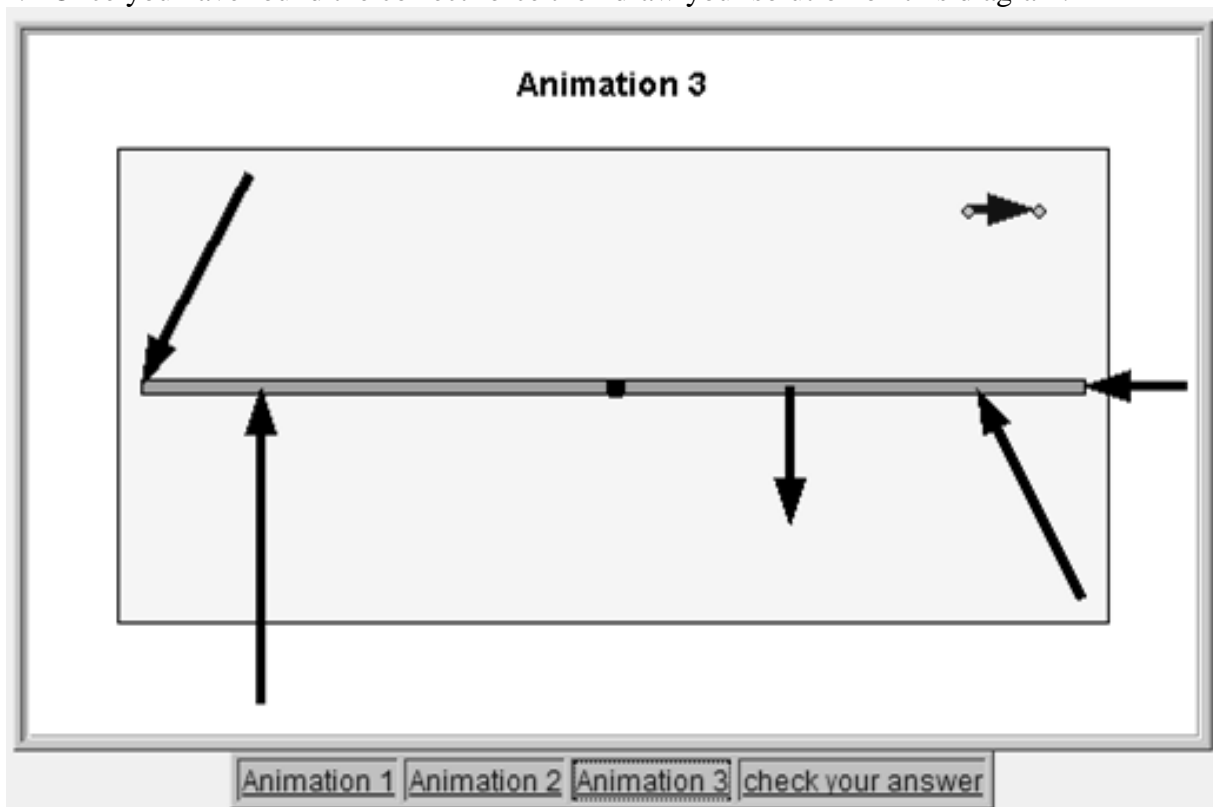
Click on Animation 3 and you will see the simulation shown here. If you add the forces shown on the rod you will notice that they do not give a net force of zero. If you add the torques they produce again you will find that the net torque is not zero. What you are going to do is apply another force to the rod to make the net force zero and the net torque zero. The force you are able to adjust is the force shown in blue in the upper right-hand corner of the simulation.

To adjust the blue force put your mouse over either the tail or the tip of the vector and mouse will turn to a hand that will allow you to adjust or move the force. To move or apply the blue force click on the tail of the vector. Move the tail of the vector to a point on the rod. To adjust the magnitude and/or direction of this force click on the tip of the vector. When you have a force that you think produces a zero net force and a zero net torque click on check your answer. The net force will appear as a red vector from the dot at the center of the rod. The net torque will be written in green below the simulation. Each time you adjust the blue force click on the check your answer to see the new results. When both of these are zero you have the correct force.



1.1 Record your net torque and draw your net force here for each trial until you find the correct force.

1.2 Once you have found the correct force then draw your solution on this diagram.



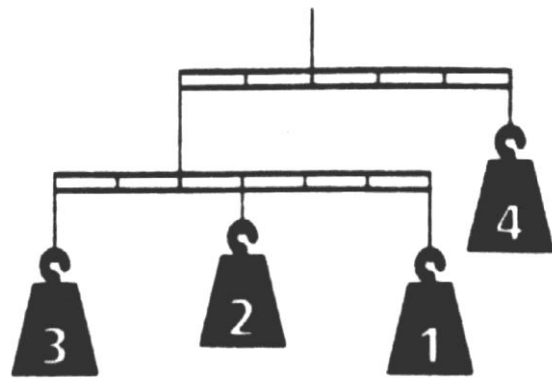
1.3 How much torque does the force on the far right of the rod produce? Explain.

Part 2: Solve the puzzles given showing all work.

The object of each puzzle below is to determine which of the given weights goes in each place on the bars to make the structure balance. So the net force and the net torque on each bar needs to be zero.

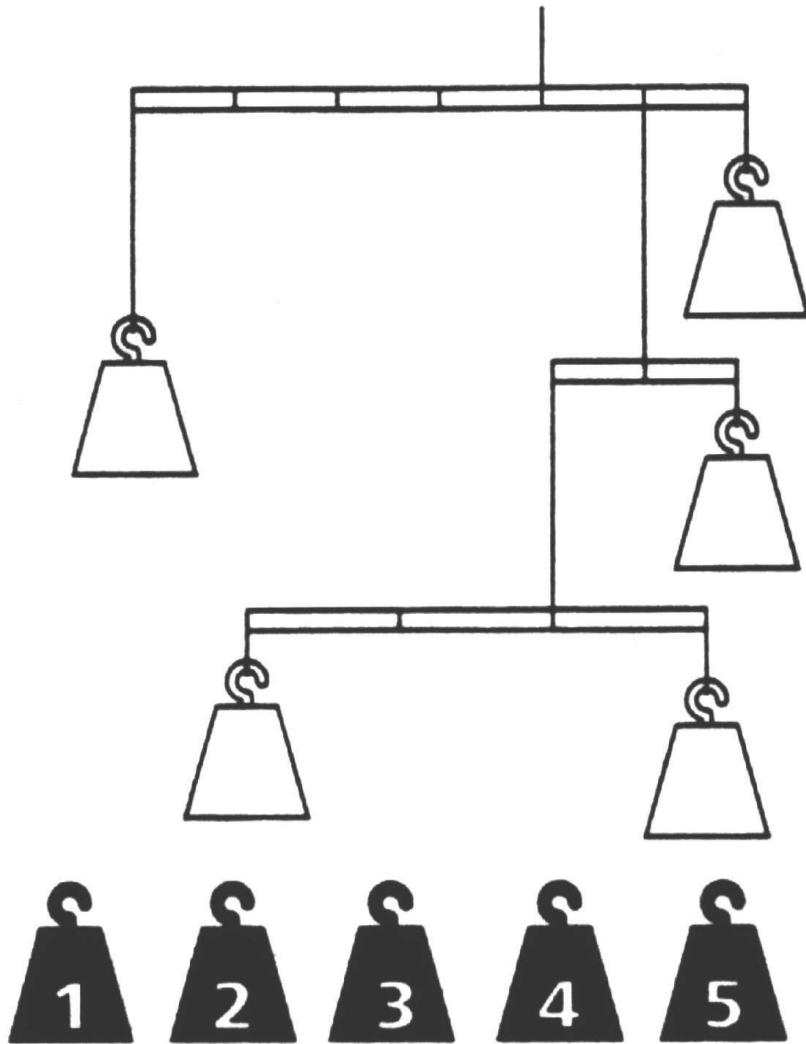
Here's how it works: For each weight that hangs off a balanced bar, take its weight and multiply it by its lever arm (in unit spaces) from the supporting cord. The sum of the torques around the supporting cord must be zero to make it balance. The tension in the supporting cord must equal the sum of the weights on the bar so that the net force on each bar is zero. (Assume the weights of the bars and cords are negligible.)

For example, the lower bar in the example at right balances because the left side has a weight of 3 that is 2 units away from the cord (a total of $3 \times 2 = 6$), while the right side has a weight of 2 that is 1 unit away and a weight of 1 that is 4 units away, for a sum of $(2 \times 1) + (1 \times 4) = 6$, the same total as the left side. The upper bar also balances because on the left side there is a weight of 6 (the 3, 2, and 1 all added together) at a distance of 2 units (the weight pulls from where the balancing string is), to make a total of $6 \times 2 = 12$, while the right side has a weight of 4 that is 3 units away, for a total of $4 \times 3 = 12$, the same total as the left side. (The lengths of the cords holding the weights are irrelevant.)



Show all work and tension in support cord for the next two puzzles.

PUZZLE 1



PUZZLE 2

