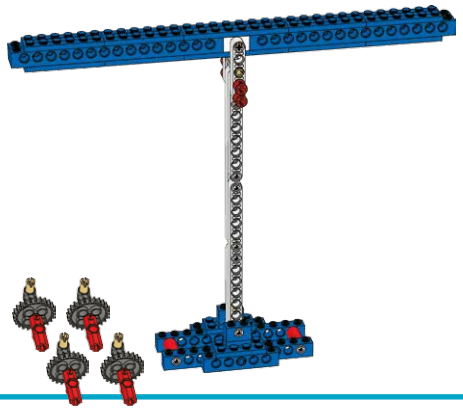
Beam Balance

Name(s): **Date and Subject:**

Build the Beam Balance and Loads

(building instructions 15A and 15B to page 9, step 9)

- Make sure the arm moves up and down freely and the beam balance is in a state of equilibrium



Why is it in a state of equilibrium?

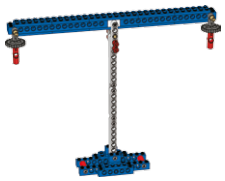
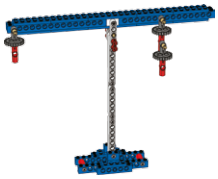
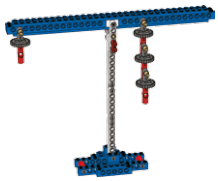
Place the load and efforts as shown and use the formulas for levers to find the mechanical advantage and to explain what happens.

First, observe the mechanical advantage of beam balance A.

Then use the formula for calculating the amount of effort needed to lift a given load to explain why the beam balance is in a state of equilibrium.

Next, follow the same procedure for beam balances B and C.

Use this formula to help explain why each model is balanced effort x length of effort arm = load x length of load arm.

	Mechanical Advantage	Weight of Load	Load Distance from Fulcrum	Weight of Effort	Effort Distance from Fulcrum
A  (page 10, step 10)					
B  (page 11, step 11)					
C  (page 12, step 12)					

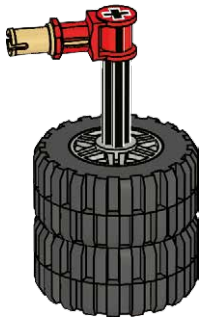
How much does it weigh?

Your challenge is to use the balance to work out the weight of assembly A.

Put assembly A one arm and balance it with preassembled weights on the other arm. Use these positions to calculate the weight of assembly A.
Use the calibrated weighing machine to check your accuracy.

Build your own set of weights from LEGO® parts and test their accuracy.

A



	Calculated Weight of Load	Measured Weight of Load	Percentage of Accuracy
A 			

Hint:
Find out how accurate your calculation was by finding the difference between the actual and calculated weight. Then divide the difference with the actual weight and multiply it by 100.

Explain your findings:

Beam Balance

Name(s): _____ **Date:** _____

NGSS GOALS	 BRONZE	 SILVER	 GOLD	 PLATINUM
1. Student work related to this Crosscutting Concept: In this project, we completed the measurements and calculations to show the proportional relationship between mechanical advantage, load weight and load distance.				
Scale, Proportion, and Quantity: Use proportional relationships to gather information about the magnitude of properties.	• We built the beam balance. • We completed the predictions and measurements for beam balance A. ☐	• We met Bronze. • We completed the predictions and measurements for beam balance B. ☐	• We met Silver. • We completed the predictions and measurements for beam balance C. ☐	• We met Gold. • We used our work on the beam balance activity to plan a solution to the 'How much does it weigh?' challenge. ☐
2. Student work related to this Practice: In this project, we tested our beam balance under different loads and completed calculations such as mechanical advantage and effort x length of effort arm = load x length of load arm. We completed the 'How much does it weigh?' challenge.				
Using Mathematics and Computational Thinking: Apply mathematical concepts such as ratio, rate, percent, basic operations and simple algebra to scientific and engineering problems.	• We wrote down the mechanical advantage for the beam balances as a ratio. ☐	• We met Bronze. • We used the formula: effort x length of effort arm = load x length of load arm for all three beam balance set-ups. ☐	• We met Silver. • We calculated a prediction for the weight of assembly A. • •We calculated our percentage of accuracy. ☐	• We met Gold. • We built two additional sets of weights to measure using our beam balance. • We calculated a prediction for their weights. • We calculated our percentage of accuracy. ☐
3. Student work related to this Practice: In this project, we used our beam balance to measure the weight of different LEGO® part assemblies. We explained what we discovered.				
Constructing Explanations: Construct an explanation that includes quantitative relationships between variables that predicts phenomena.	• We explained what we discovered. • Our explanation included at least one example calculation. ☐	• We met Bronze. • Our explanation used more than two example calculations. ☐	• We met Silver. • Our explanation outlined how we used equations to predict the weights of LEGO Assemblies. ☐	• We met Gold. • Our explanation included our percentage of accuracy results. • We described ideas for improving the accuracy of our beam balance. ☐
Notes:				