Beam Balance

Science
- Experiment and measure the effect of force on an object
- Forces
- Scientific investigation
- Simple machines – Lever

Technology
- Assembling components
- Construct simple machines
- Evaluating
- Mechanical advantage
- Properties of materials

Engineering
- Describe and explain parts of a structure and the effects of loads
- Test and evaluate before making improvements

Mathematics
- Determine percent of error
- Develop, analyze, and explain methods for solving problems involving proportions, such as scaling and finding equivalent ratios
- Select and apply techniques to accurately find length measures to appropriate levels of precision
- Solve problems involving scale factors, using ratio and proportion

Vocabulary
- Effort
- Equilibrium
- Fulcrum
- Levers
- Load
- Weight

Other materials required
- Measuring tape
- Calibrated weighing machine

Connect

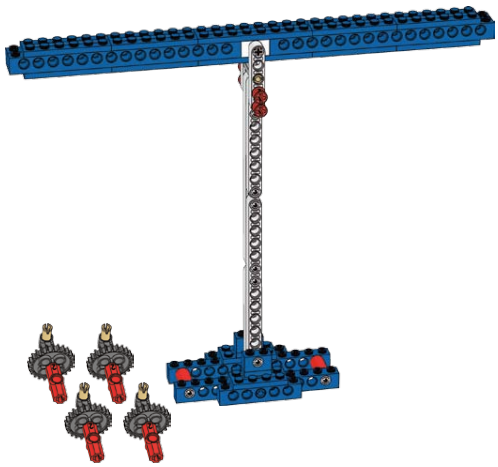
The simplest weighing machine is a beam balance. The original form of a balance consisted of a beam with a fulcrum at its center. A change of weigh on either side of the balance will change the beams positioning and effect the balance achieved.

You will build a model Beam Balance and investigate how its function is influenced by changes in weight and position.

Construct

Build the Beam Balance and Loads
(Building Instruction 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



Contemplate

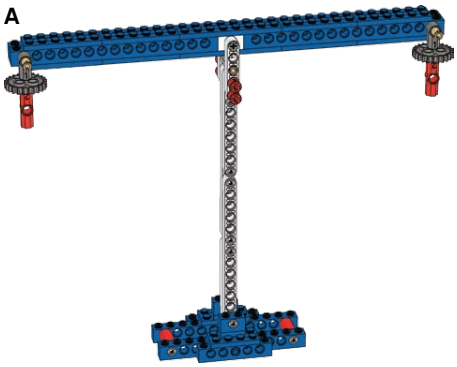
Why is it in a state of equilibrium?
Place the load and efforts as shown and use the formulas for levers to find the mechanical advantage and to explain what happens.

First, observe the mechanical advantage of Beam Balance A.
Record the mechanical advantage on the worksheet.

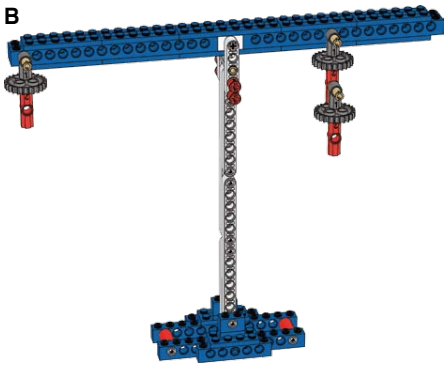
Then use the formula for calculating the amount of effort needed to lift a given load to explain why the Beam Balance is in a state of equilibrium.
Record your findings on the worksheet.

Next, follow the same procedure for Beam Balance B and C.

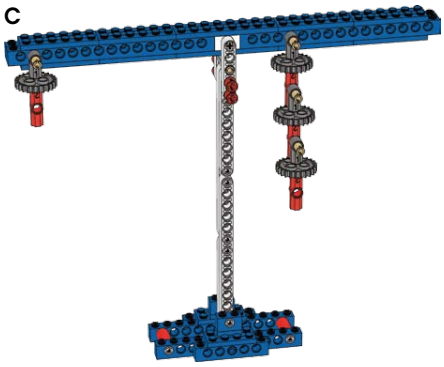
A



B



C



Hint:
You can find all of the formulas you need to perform this investigation in the Principle Models section for Lever.

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

Did you know?

The loads weigh 2 g each.

Continue

How much does it weigh?
Your challenge is to use the balance to work out the weight of assembly A.

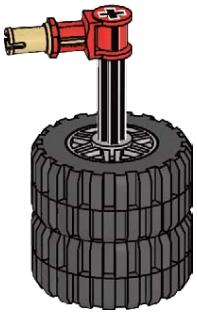
First, put assembly A on one arm and the preassembled weights on the other arm to find the position where the balance is in equilibrium.

Then use these positions to calculate the weight of assembly A.

Next, use the calibrated weighing machine to check your accuracy.
Record and explain your findings on the worksheet.

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

A



Hint:
Use this formula for calculating the amount of effort needed to lift a given load:
Effort x length of effort arm = Load x length of load arm.

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.