Ramp

Science
- Experiment and measure the effect of force on an object
- Scientific investigation
- Simple Machines – Inclined Plane
- Simple Machines – Wheel and Axle

Technology
- Assembling components
- Construct simple machines
- Evaluating
- Mechanical advantage

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

Mathematics
- Determine percent of error
- Select and apply techniques and tools to accurately find length and angle measures to appropriate levels of precision
- Understand the metric system of measurement

Vocabulary
- Angle
- Efficiency
- Effort
- Friction
- Load
- Inclined Plane
- Mechanical advantage

Other materials required
- 30 cm (≈ 11.8 in) plank of wood or thick piece of cardboard
- 60 cm (≈ 23.6 in) plank of wood or thick piece of cardboard
- Fabrics and abrasive papers to create different surfaces
- Measuring tape
- Weighing scales
- Pile of books or boxes to elevate the planks

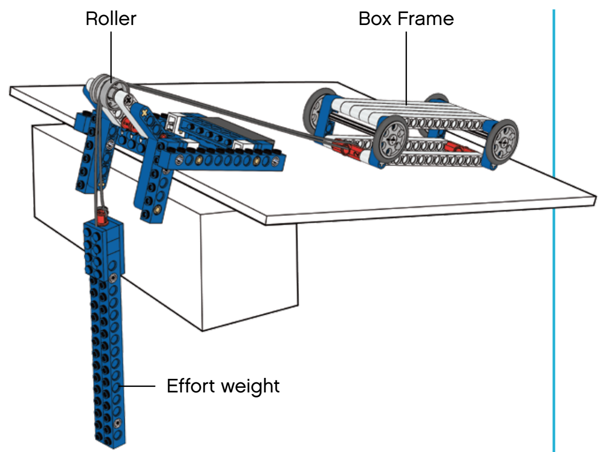
Connect

Ramps have been used since ancient times to help move heavy objects or large quantities of materials from one level to another. Today, automobile transport services use ramp on their trucks to load multiple vehicles on one transport. These multi-vehicle transports use ramps for easy of use, safety and efficiency.

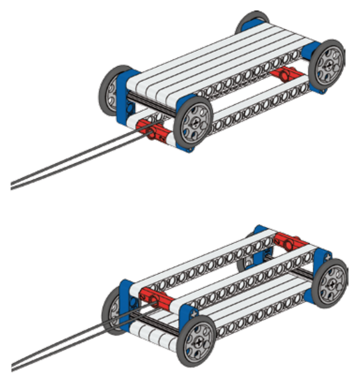
You will build a model Ramp and the Box Frame and investigate how angle and wheels affects the needed effort.

Construct

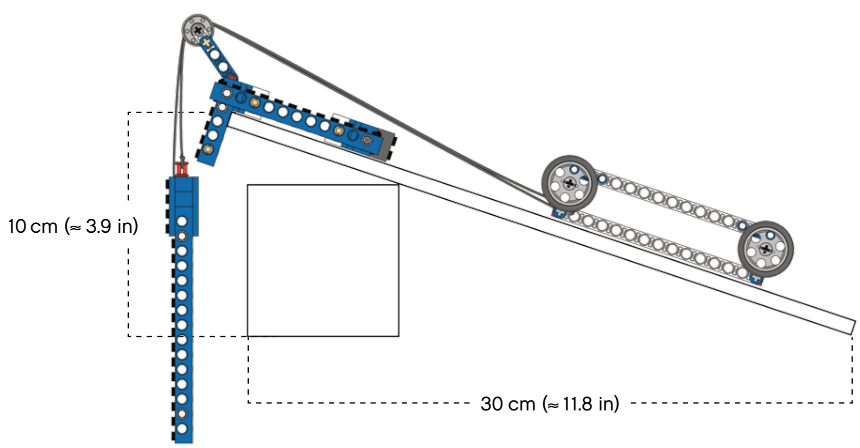
Build the Box Frame, roller and effort weight
(Building Instruction 17A and 17B to page 11, step 15)



- Make sure the wheels on the Box Frame turn freely
- The Box Frame can be turned upside down, to be used as a sled, without the wheels. Or turned around again as a cart with wheels



Build the Ramp
- Place a support so the top of the 30 cm (≈ 11.8 in) plank is situated 10 cm (≈ 3.9 in) off the floor
- Place the Box Frame on the Ramp and the roller at the top edge. Let the effort weight hang lose over the edge
- Have the 60 cm (≈ 23.6 in) plank ready to make changes to the Ramp



Contemplate

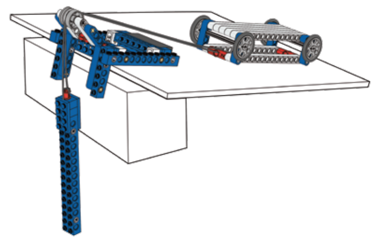
What is the advantage of using the Ramp?
Investigate the difference between ideal and actual mechanical advantage.

First, calculate the ideal mechanical advantage and predict how much effort is actually needed to pull the Box Frame A to the top of the Ramp. *Record the mechanical advantage and your predictions on the worksheet.*

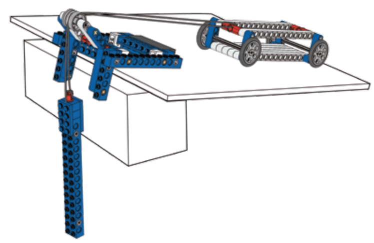
Then test how much effort is needed by adding LEGO® bricks to the effort weight and calculate the actual mechanical advantage. *Record your findings on the worksheet.*

Next, follow the same procedure for Box Frame B, C and D.

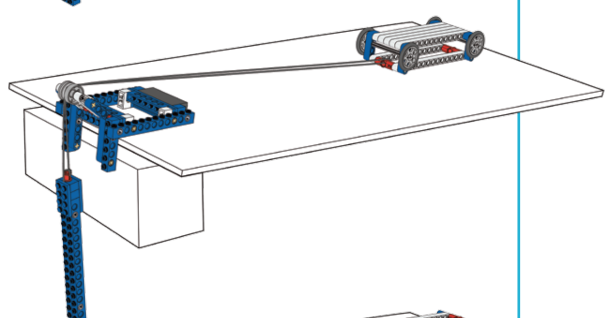
A



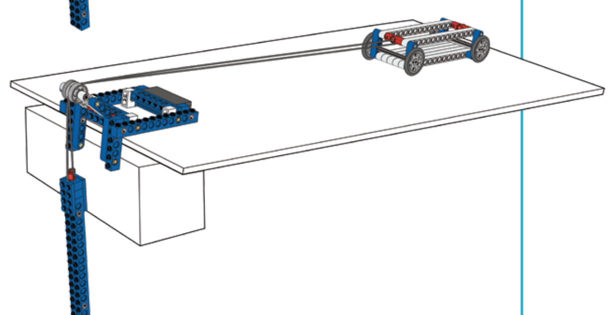
B



C

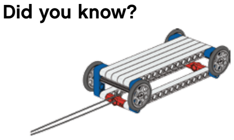


D



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

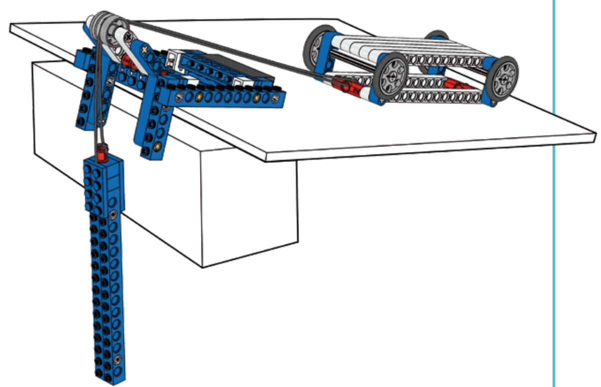
Did you know?



The Box Frame weighs 52 g.

Continue

Redesign needed?
A Ramp can come in many shapes and sizes to match specific needs.
Now redesign the Ramp to make it the best in its class. We have highlighted some questions you could explore. Choose one area that you would like to investigate.



Then design a test that will help you explore how it functions and possible additional improvements you could make to your new Ramp. Remember to record all your test results.