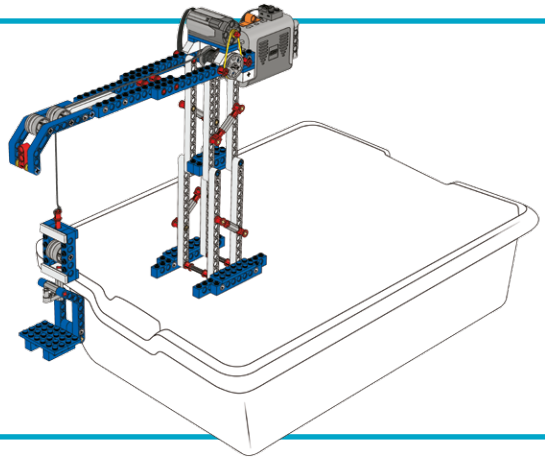
Tower Crane

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

Build the Tower Crane and Load

(building instructions 16A and 16B to page 28, step 38)

- Place the tower crane on the lid of the blue LEGO® storage box
- Turn on the motor by pushing the battery box switch forward and let the string unwind and then let the motor wind it back up again
- Make sure all pulley wheels turn freely



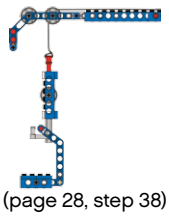
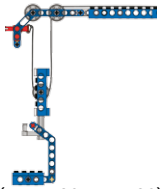
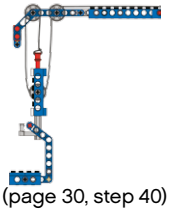
Why do cranes use pulleys?

Cranes use pulley systems because they can pull with less effort than is needed in a direct lift.

First, observe the mechanical advantage and predict with which speed pulley setup A will lift the load.

Then test your prediction. Next, follow the same procedure for pulley setups B and C.

Test several times to make sure your results are consistent.

	Mechanical Advantage	My Prediction	Length Lifted	Lifting Time	Speed
A  (page 28, step 38)					
B  (page 29, step 39)					
C  (page 30, step 40)					

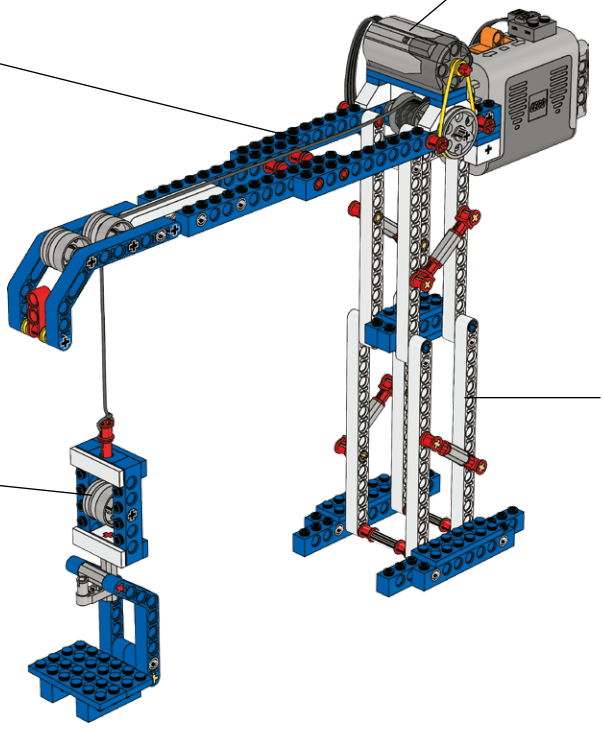
Redesign needed?

Tower cranes are often built to match specific needs. Now redesign the tower crane to make it the best in its class. We have highlighted some question 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 tower crane. Remember to record all of your test results.

What if you wanted to pick up from one place and put down to the left or right of that place – how would you change the structure where the jib meets the tower?

What if you wanted to lift loads more quickly – how would you change the arrangement for raising the pulley?



What if you wanted to lift heavier loads – how would you change the pulley?

What if you want the crane to lift loads higher – how would you change the tower?

Tower Crane

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

NGSS GOALS	 BRONZE	 SILVER	 GOLD	 PLATINUM
1. Student work related to this Crosscutting Concept: In this project, we explored the cause and effect relationship between the pulley arrangement in our tower crane and the weight and speed of the load we lift.				
Cause and Effect: Students use cause and effect relationships to explain and predict behaviors in design systems.	• We observed our tower crane lift an object with pulley setup A. • We predicted what would happen with pulley setup B. ☐	• We met Bronze. • We noted how pulley setup B caused a change in our lifting length and lifting time. • We predicted what would happen with pulley setup C. ☐	• We met Silver. • We noted how pulley setup C caused a change in our lifting length and lifting time. • We observed what was different about each pulley setup. ☐	• We met Gold. • We explained the functions and possible additional improvements of the new tower crane. ☐
2. Student work related to this Practice: In this project, we built a working model of a tower crane to test different types of pulley systems.				
Developing and Using Models: Develop and use a model to generate data to test ideas about phenomena in designed systems, including those representing inputs and outputs.	• We built the tower crane with pulley setup A. • We completed our measurements and calculations for pulley setup A. ☐	• We met Bronze. • We built pulley setup B. • We completed our measurements and calculations for pulley setup B. • We completed our tests of A and B at least twice. ☐	• We met Silver. • We built pulley setup C. • We completed our measurements and calculations for pulley setup C. • We completed all of our tests at least three times. ☐	• We met Gold. • We made changes to the two pulleys found near the motor. • We used our observations of this experiment to help us answer our redesign questions. ☐
3. Student work related to this Practice: In this project, we redesigned our tower crane. We developed an investigation to explore how the new design functions.				
Planning and Carrying Out Investigations: Collect data about the performance of a proposed object.	• We picked a redesign question. • We created a data table to organize our measurements and observations. ☐	• We met Bronze. • We identified our independent and dependent variables. • We completed at least two tests. ☐	• We met Silver. • We identified our experimental controls (what we kept constant for each experiment). • We completed at least three tests. • Our data helped us evaluate our redesign. ☐	• We met Gold. • We completed multiple trials for all of our tests. • We created a new data table to clearly compare our redesign test results with the data from our first experiments. ☐

Notes: