Making Things Move

STEM-Maker CURRICULUM

v2.3

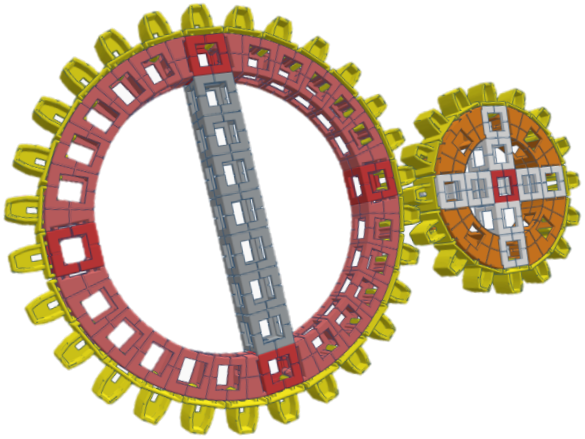
STEM Fundamentals: Engineering Basics | Curriculum Packet

Introduction

In this lesson, students will learn how Kid Spark engineering materials can be used to create different types of movement.

Click here **to explore the entire Kid Spark Curriculum Library.**

Activity Time: 180 Minutes



NGSS Learning Dimensions

This Kid Spark lesson engages students in the following learning dimensions of the Next Generation Science Standards:

Scientific/Engineering Practice:
Developing and using models

Crosscutting Concept:
Structure and function

Learning Objectives

- Become familiar with how engineering materials can be used to create movement in a design.
- Complete step-by-step builds that demonstrate how specific engineering materials create movement.
- Use engineering materials to complete a series of design challenges.
- Become comfortable in the ability to create a desired type of movement within a design.

Educational Standards

NGSS

K-5-ETS1-3 Engineering Design

MS-ETS1-4 Engineering Design

ITEEA

STL8- Attributes of Design

STL9- Engineering Design

STL12- Use Technological Systems

Resources

The following resources will be used to complete this lesson.

1. Kid Spark Curriculum

Making Things Move
a. Curriculum Packet

2. Kid Spark Mobile STEM Lab (Pictured Right)

Resources

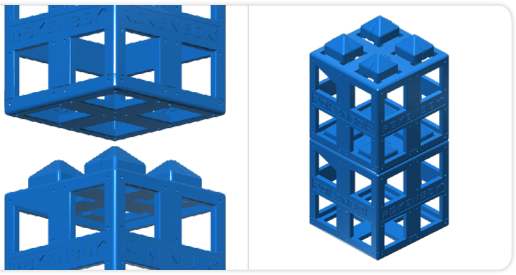
ROK Blocks Mobile STEM Lab
***Up to 4 students per lab**

Building Basics

The following tips will be helpful when using Kid Spark engineering materials.

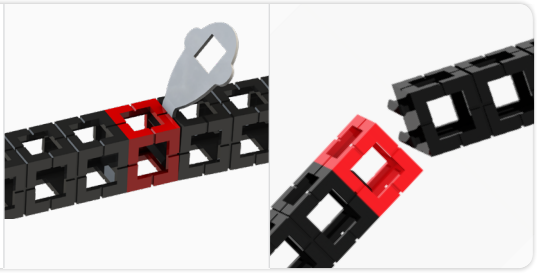
Connecting/Separating ROK Blocks:

ROK Blocks use a friction-fit, pyramid and opening system to connect. Simply press pyramids into openings to connect. To separate blocks, pull apart.



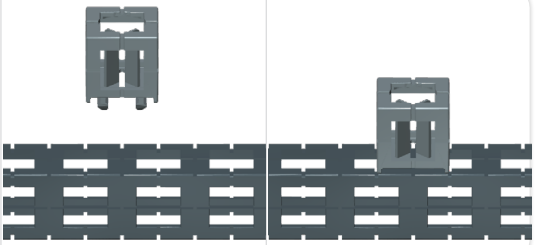
Connecting/Disconnect Smaller Engineering Materials:

Smaller engineering materials use a tab and opening system to connect. Angle one tab into the opening, and then snap into place. To disconnect, insert key into the engineered slot and twist.



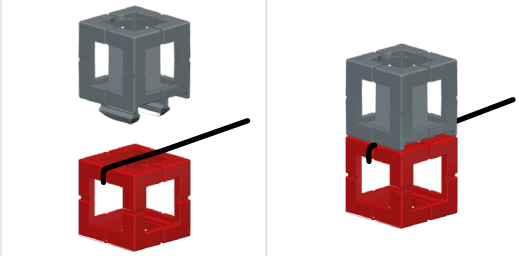
Snapping Across Openings:

Materials can be snapped directly into openings or across openings to provide structural support to a design. This will also allow certain designs to function correctly.



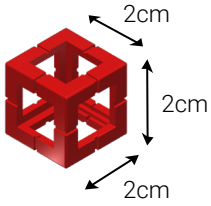
Attaching String:

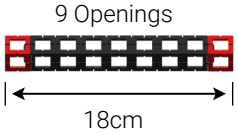
In some instances, string may be needed in a design. Lay string across the opening and snap any component with tabs or pyramids into that opening. Be sure that the tabs are perpendicular to the string to create a tight fit.

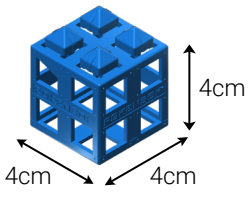


Measuring:

The outside dimensions of a basic connector block are 2 cm on each edge. This means the length, depth, and height are each 2 cm. To determine the size of a project or build in centimeters, simply count the number of openings and multiply by two. Repeat this process for length, depth, and height.





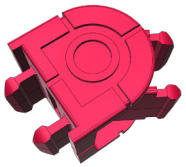


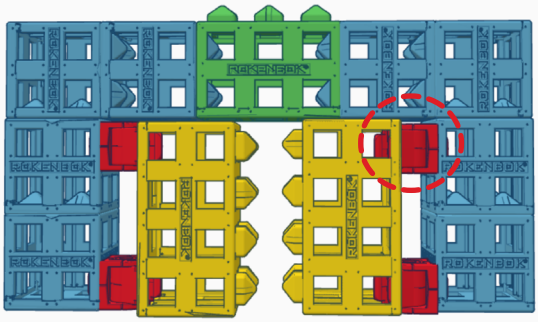
Introduction

An important part of engineering is the ability to make things move. Whether it is making a car, a gear train, opening a door, or building a catapult, it is important to understand how to create different types of movement. This lesson will review how different engineering materials in the ROK Blocks Lab can be used to create movement.

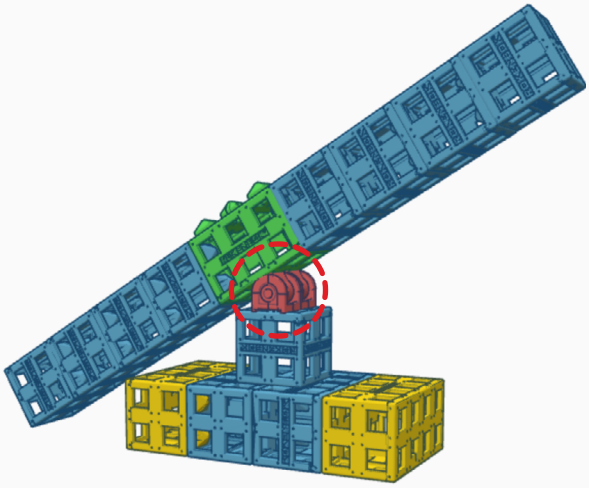
Hinge Block

The hinge block is a very useful piece for making things that need to move from side to side or up and down. The hinge block fits in any opening, but it can be a little difficult to insert, so try snapping it in at an angle. Review the following examples, then complete the design challenge listed below.





Example 1: Door Hinge
In this example, four hinge blocks are attached to the doors on the structure. This allows the doors to open and close.

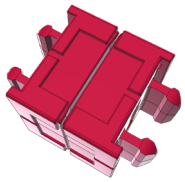


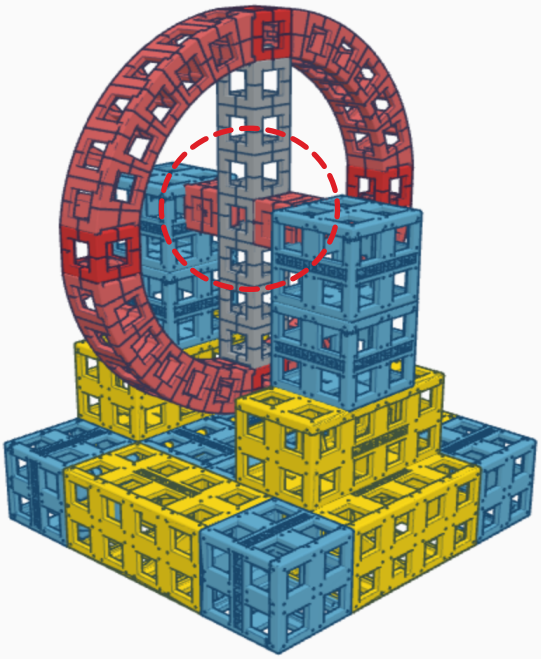
Example 2: Lever/Teeter Totter
In this example, one hinge block is attached to a beam and frame to make a lever or teeter totter. When one side of the lever is pressed down, the other side is raised.

Design Challenge: Design and engineer a door or lever that moves. It can be similar to the examples shown above, or it can be a new design. Make sure to include a hinge block in the design.

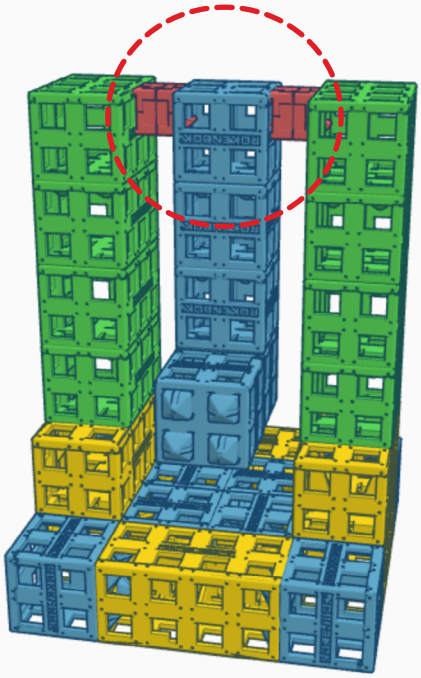
Axle Block

The axle block is used when a design calls for a rotating or twisting motion. The axle block has a pin in the center that allows one half of the piece to rotate, while the other half remains stationary. Review the following examples, then complete the design challenge listed below.





Example 1: Wheel
In this example, two axle blocks are attached to the sides of a wheel. The wheel is mounted between two structures. The axle blocks allow the wheel to rotate in place.

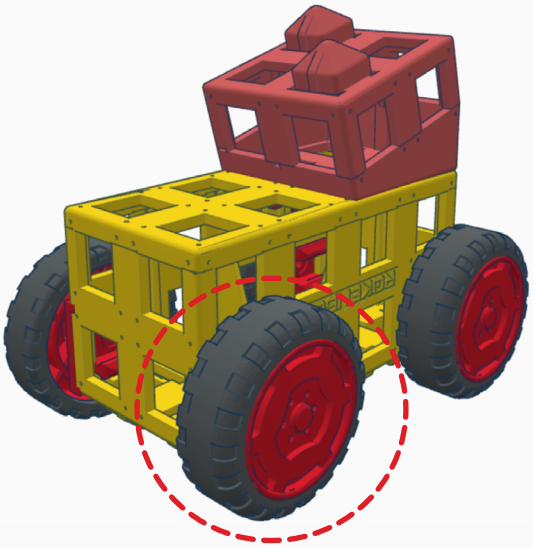


Example 2: Swing
In this example, two axle blocks are attached to a swing. The swing is mounted between two structures. The axle blocks allow the swing to freely move back and forth between the structures.

Design Challenge: Design and engineer a wheel or swing that moves. It can be similar to the examples shown above, or it can be a new design. Make sure to include an axle block in the design.

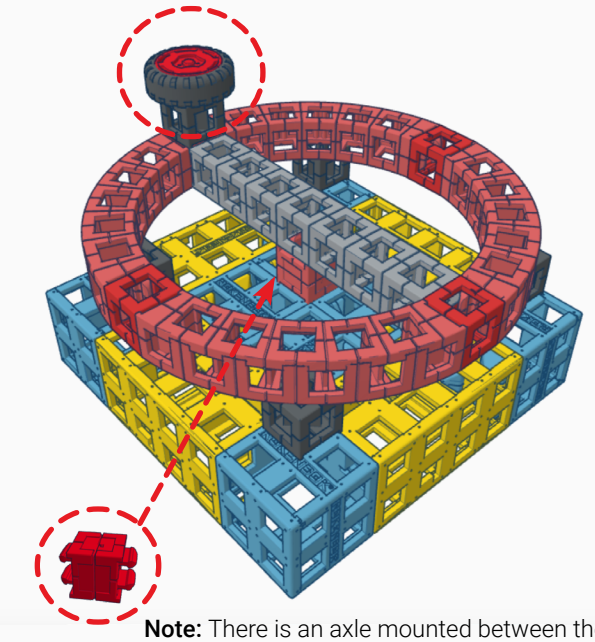
Snap-In Wheel

Snap-In Wheels can provide a great way to make things move. These wheels simply snap into any opening. Once the wheel has been snapped into place, it will spin freely. Review the following examples, then complete the design challenge listed below.



Example 1: Car

In this example, four snap-in wheels have been snapped onto a car. The wheels allow the car to move around just like a car in real life.



Note: There is an axle mounted between the large wheel and the base which allows it to rotate.

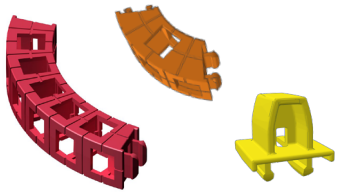
Example 2: Turning Knob

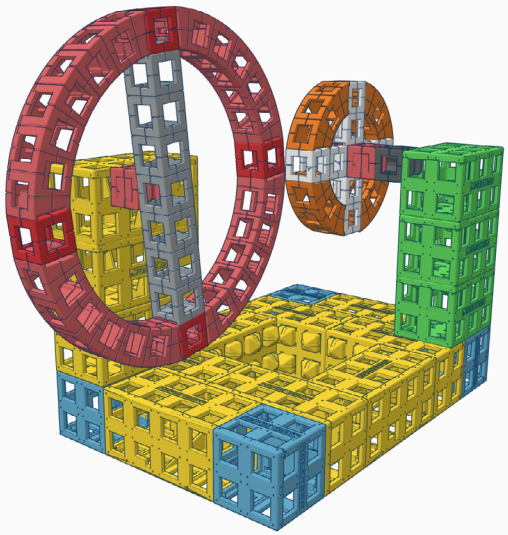
In this example, a snap-in wheel is being used as a turning knob to turn the larger wheel. Many farmers use a wheel knob just like this to steer a tractor.

Design Challenge: Design and engineer a car or wheel that moves. It can be similar to the examples shown above, or it can be a new design. Make sure to include a snap-in wheel in the design.

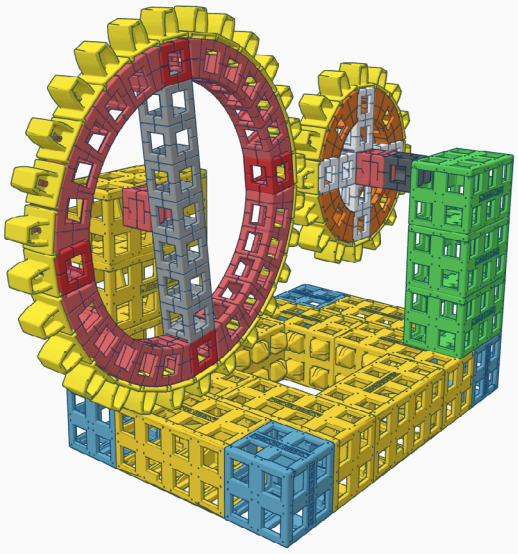
Curved Beams and Gear Teeth

The curved beams included in the ROK Blocks STEM lab can be used to form wheels, curved structures, and used with gear teeth to form gears. Gears are wheels that have teeth placed on them that interlock with the teeth from another wheel to form what is called a gear train. Review the following examples, then complete the STEM-Maker Build listed below.





Example 1: Wheels
In this example, the small and medium curved beams have been used to make two wheels. An axle block has been attached to the center of both wheels. The wheels are attached to two seperate structures allowing them to spin freely.



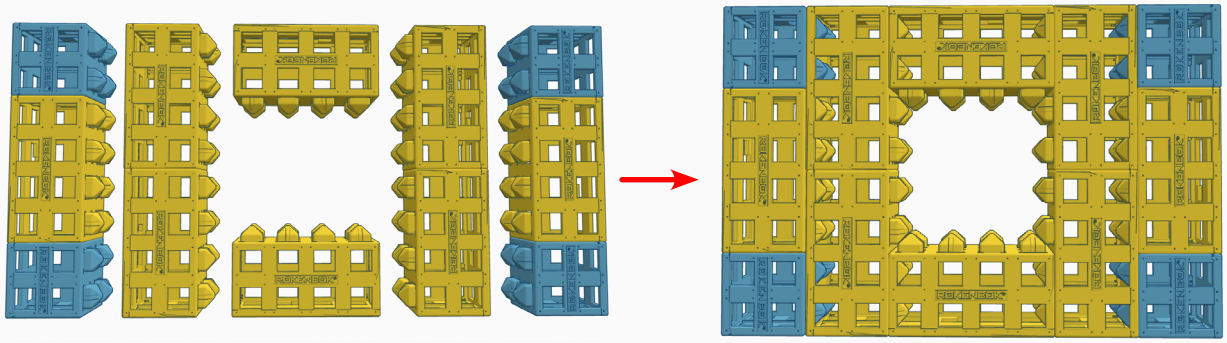
Example 2: Gear Train
In this example, gear teeth have been added to both wheels. The gears have been placed so that the teeth from the larger wheel interlock with the teeth from the smaller wheel. Now, if one wheel is turned, the other wheel will turn in the opposite direction.

STEM-Maker Build: Complete the step-by-step instructions on the following pages to assemble a gear train featuring the curved beams and gear teeth. This build will also be used for the following section (Bearing Module), so make sure not to disassemble it.

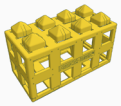
STEM-Maker Build: Gear Train

Follow the step-by-step instructions to build a gear train.

1

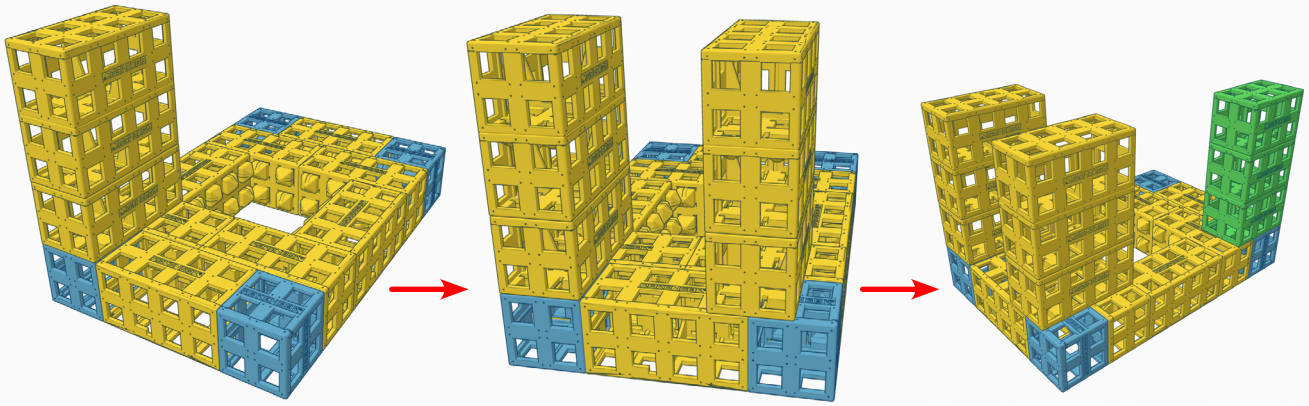


8x
Yellow ROK Block

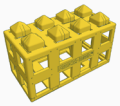


4x
Blue ROK Block

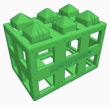
2



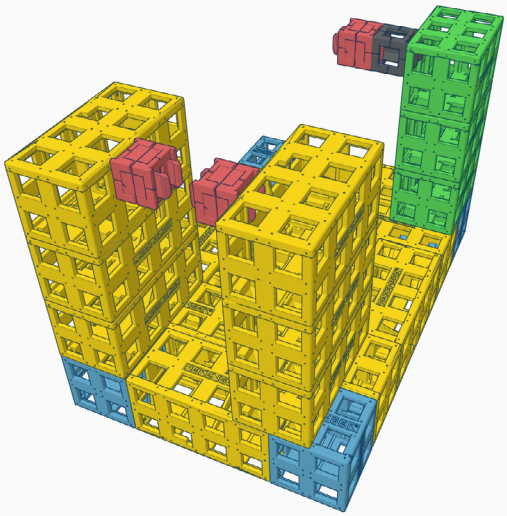
6x
Yellow ROK Block



3x
Green ROK Block

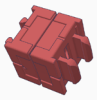


3



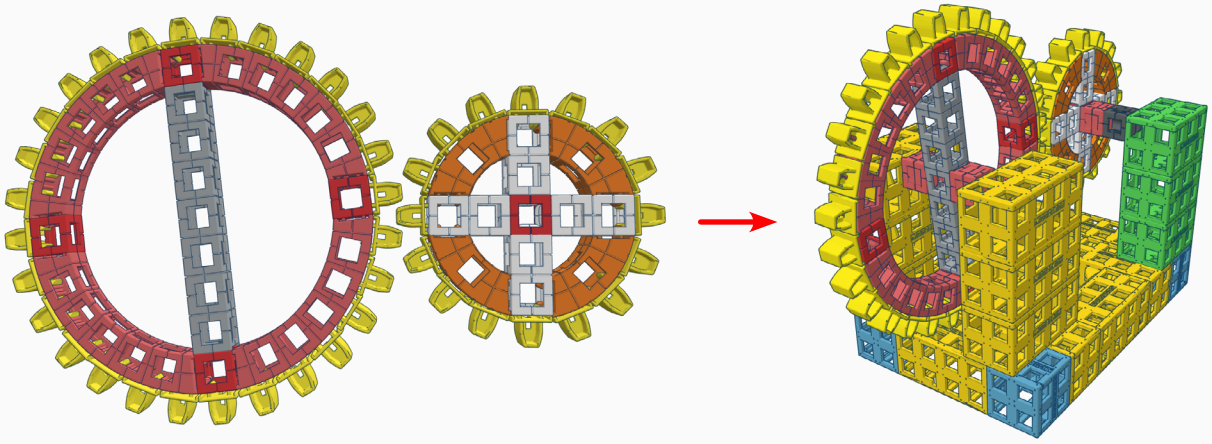
Note:
Pay close attention to the placement of the axle blocks in this section. If they are misplaced the gears will not align.

3x
Axle Block



1x
Single Snap Block

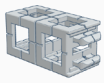
4



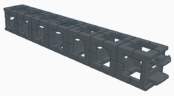
5x
Block

4x
Small Curved Beam

4x
Riser



1x
Beam

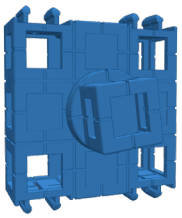


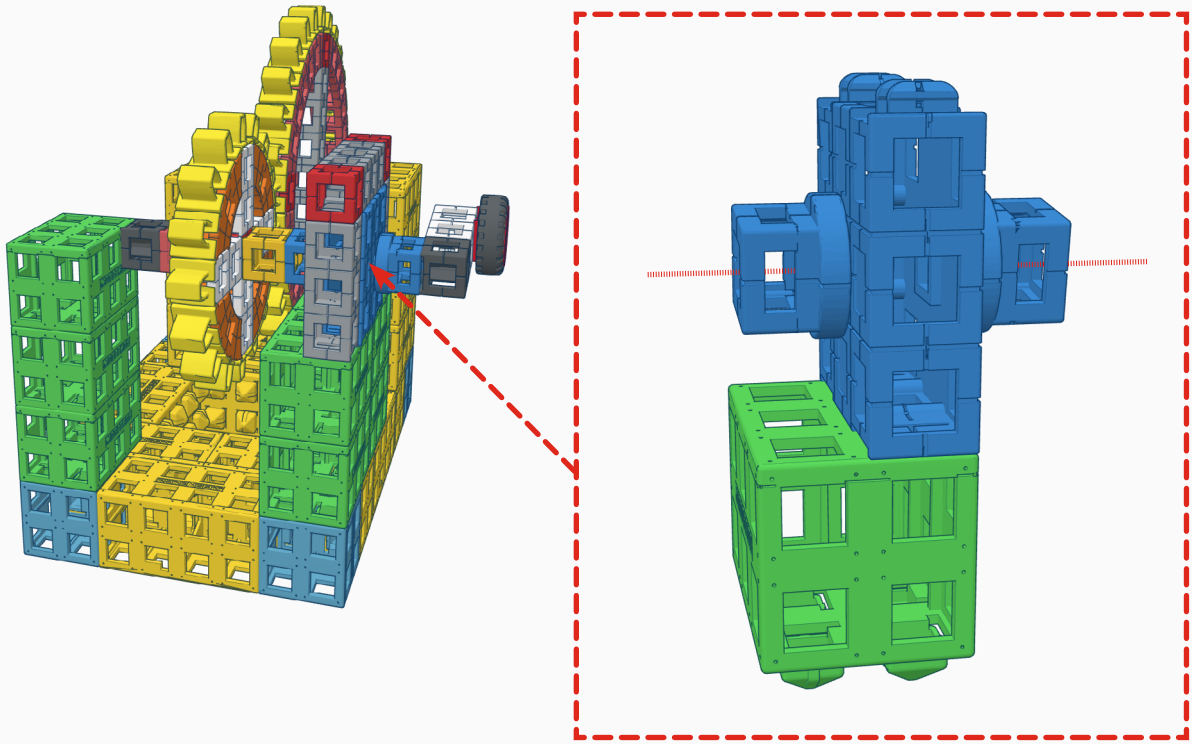
4x
Mini Curved Beam

44x
Gear Teeth

Bearing Module

The bearing module is designed to allow rotating motion to be transferred through a beam or structure. Locate the bearing module in the tray of the ROK Blocks Lab and observe how it works, then continue the STEM-Maker Build that was started in the previous section.





Example: Gear Train w/Crank Handle

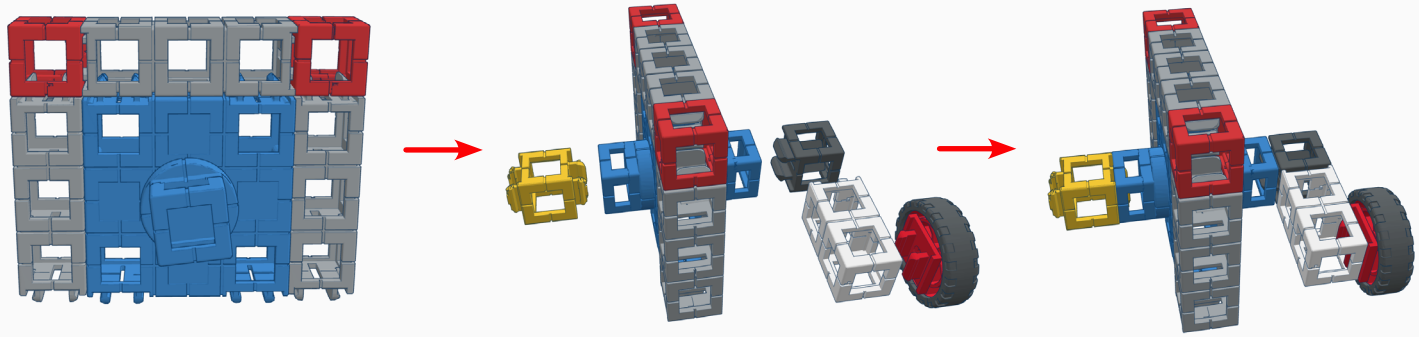
In this example, one side of a bearing module has been connected to the small gear in the gear train, and a crank handle has been connected to the other side. The body of the bearing module is firmly attached to the structure. As the crank handle is rotated, power is transferred through the body of the bearing module and to the connected gear, allowing it to rotate.

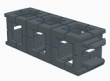
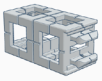
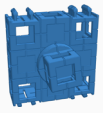
STEM-Maker Build: Complete the step-by-step instructions on the following pages to continue assembling the gear train.

STEM-Maker Build: Gear Train (Continued)

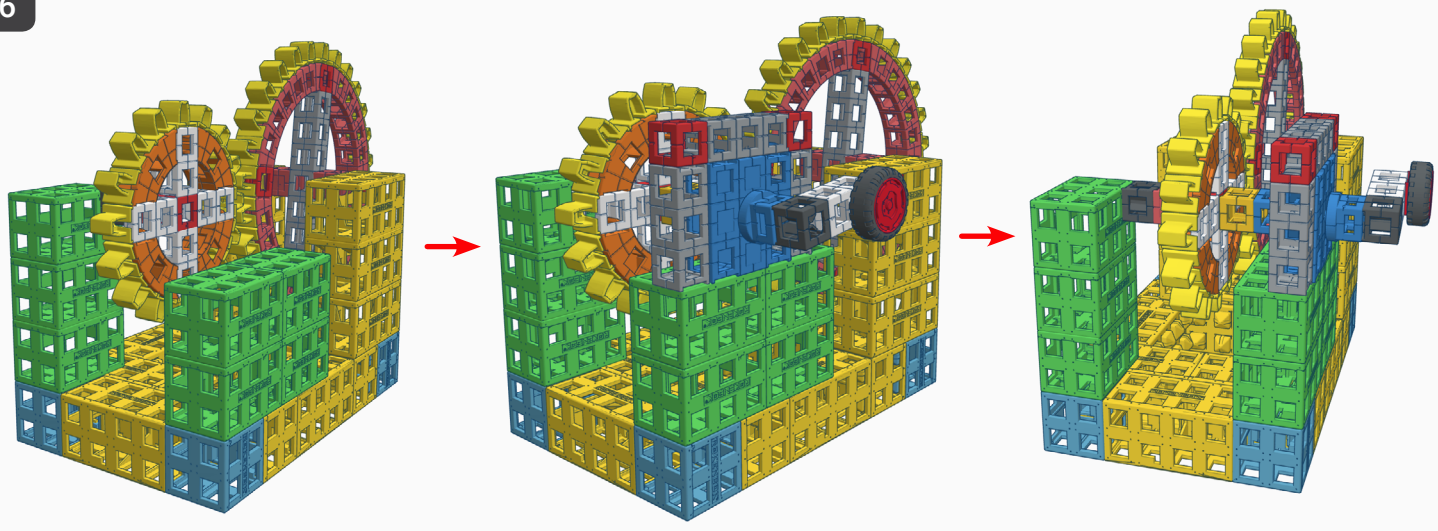
Complete the step-by-step instructions to continue building the gear train.

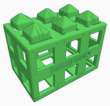
5



2x Block	3x Half Beam	1x Single Snap Block	1x Riser	1x Snap-In Wheel	1x Double Snap Block	1x Bearing Module
						

6



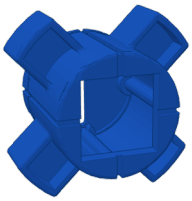
4x Green ROK Block


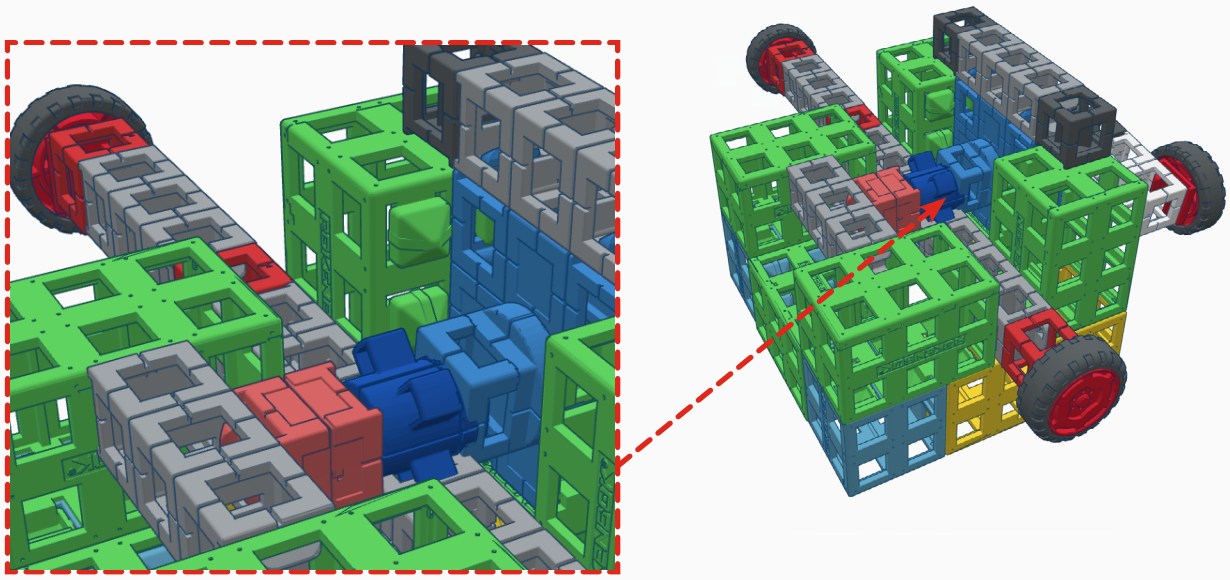
Gear Train

Now that the gear train has been completely assembled, turn the knob and observe how the smaller gear turns the larger gear. Look closely as the gears are moving. Are both gears rotating in the same direction? How many revolutions does the smaller gear have to make for the larger gear to make one revolution? You can use corbels as markers to help count gear rotations by placing one on the side of each gear in the same position.

Snap-in Cog

The snap-in cog is a small gear that is used to move beams or other engineering materials. The gear teeth of the cog are designed to fit into the openings of engineering materials. The cog is usually used in conjuction with the bearing module to create a push or pull movement. Review the following example, then complete the STEM-Maker Build listed below.





Example: Push/Pull Rod

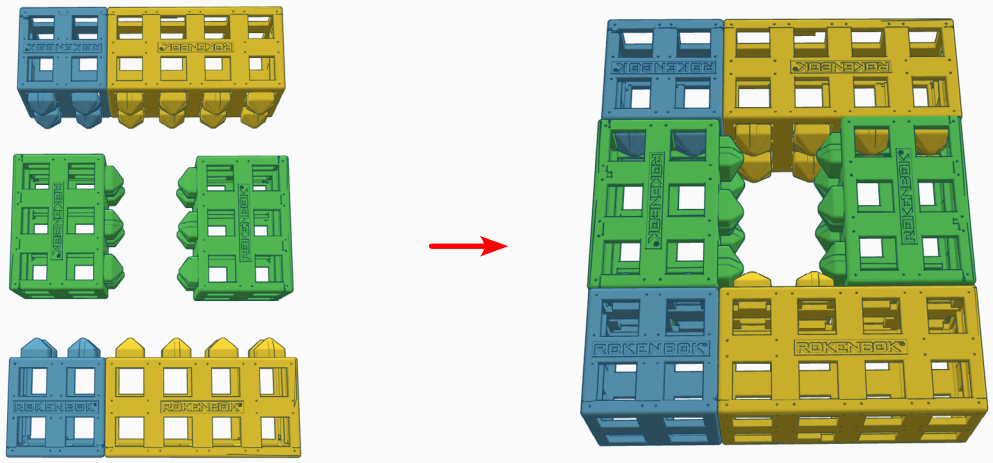
In this example, a snap-in cog has been connected to one side of a bearing module, and a crank handle has been attached to the other side. The body of the bearing module is firmly attached to the structure. As the crank handle is turned, power is transferred through the body of the bearing module, to the cog. As the cog rotates, the teeth of the cog push or pull the beam backward or forward.

STEM-Maker Build: Complete the step-by-step instructions on the following pages, to assemble a push/pull rod.

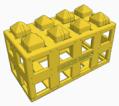
STEM-Maker Build: Push/Pull Rod

Complete the step-by-step instructions to build a push/pull rod.

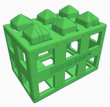
1



2x
Yellow ROK Block

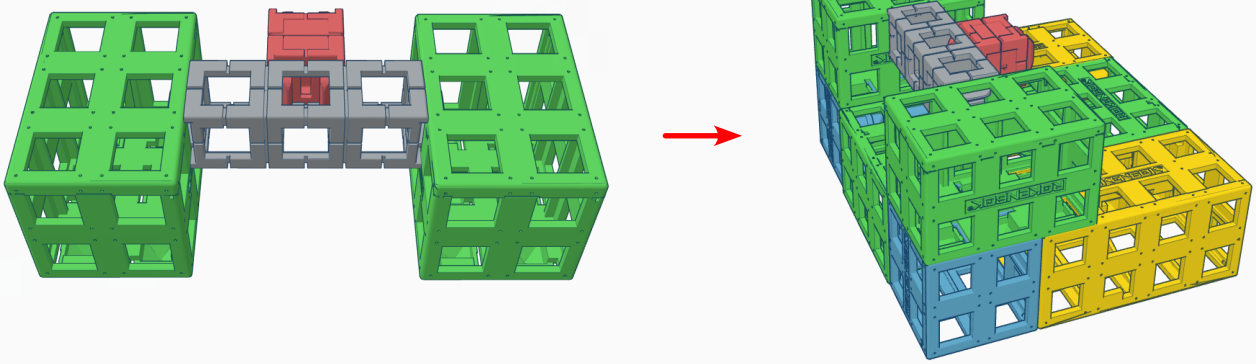


2x
Green ROK Block

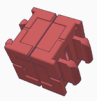


2x
Blue ROK Block

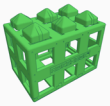
2



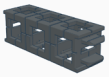
1x
Axle Block



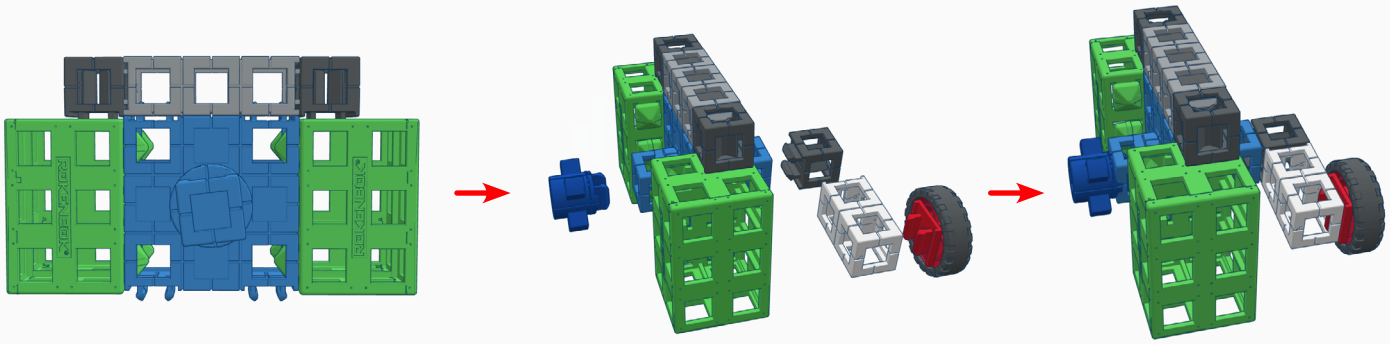
2x
Green ROK Block



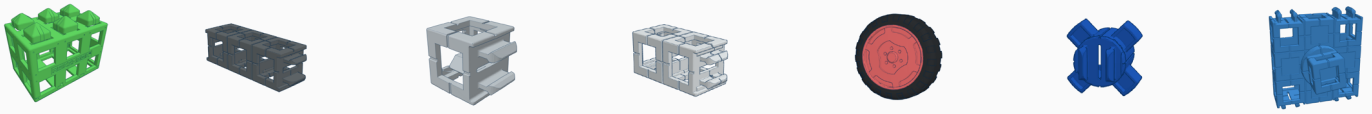
1x
Half Beam



3



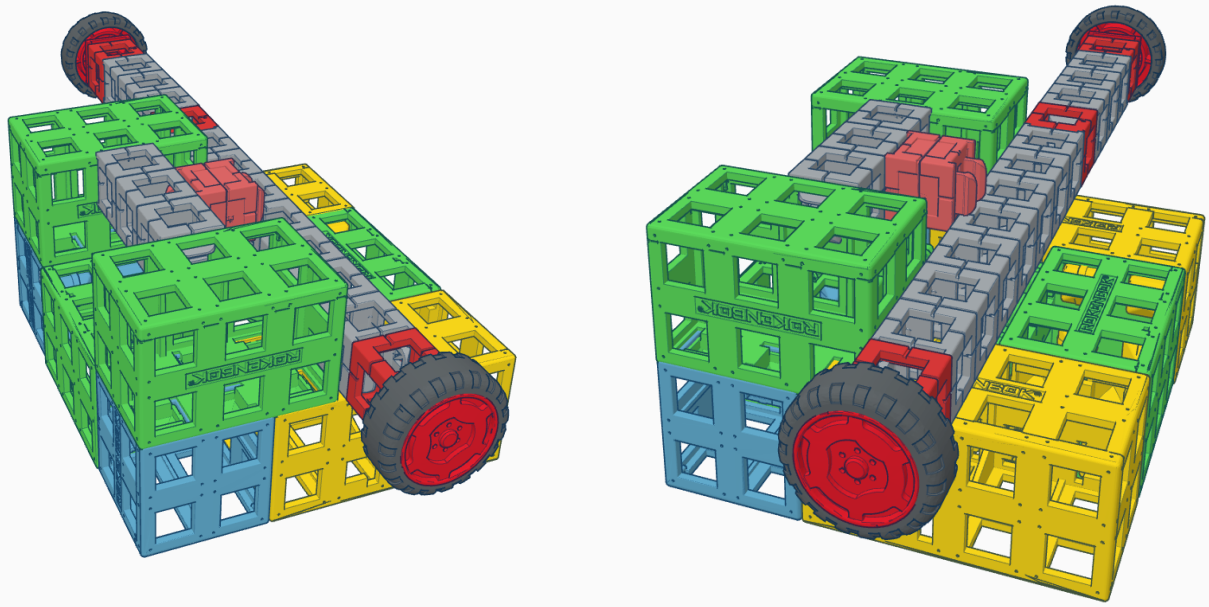
2x	1x	3x	1x	1x	1x	1x
Green ROK Block	Half Beam	Single Snap Block	Riser	Snap-In Wheel	Cog	Bearing Module



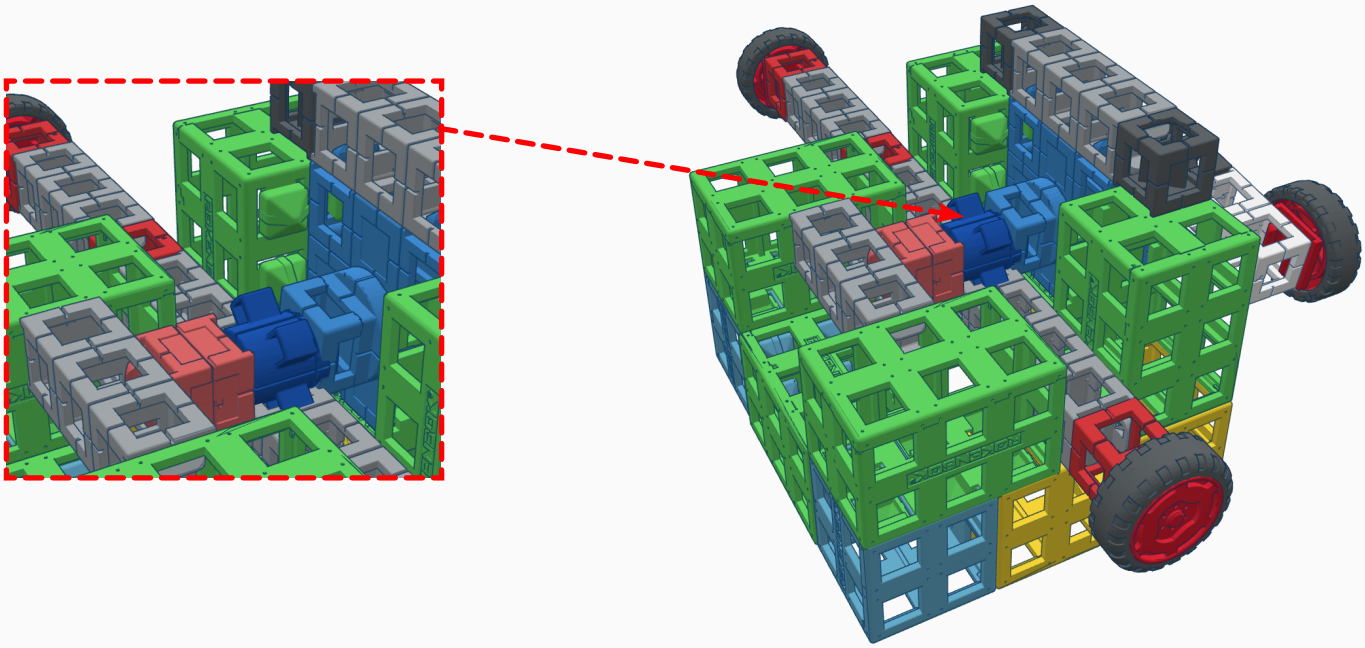
4

1x	1x	2x	3x
Beam	Half Beam	Snap-In Wheel	Block

5



6

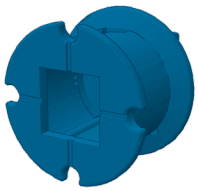


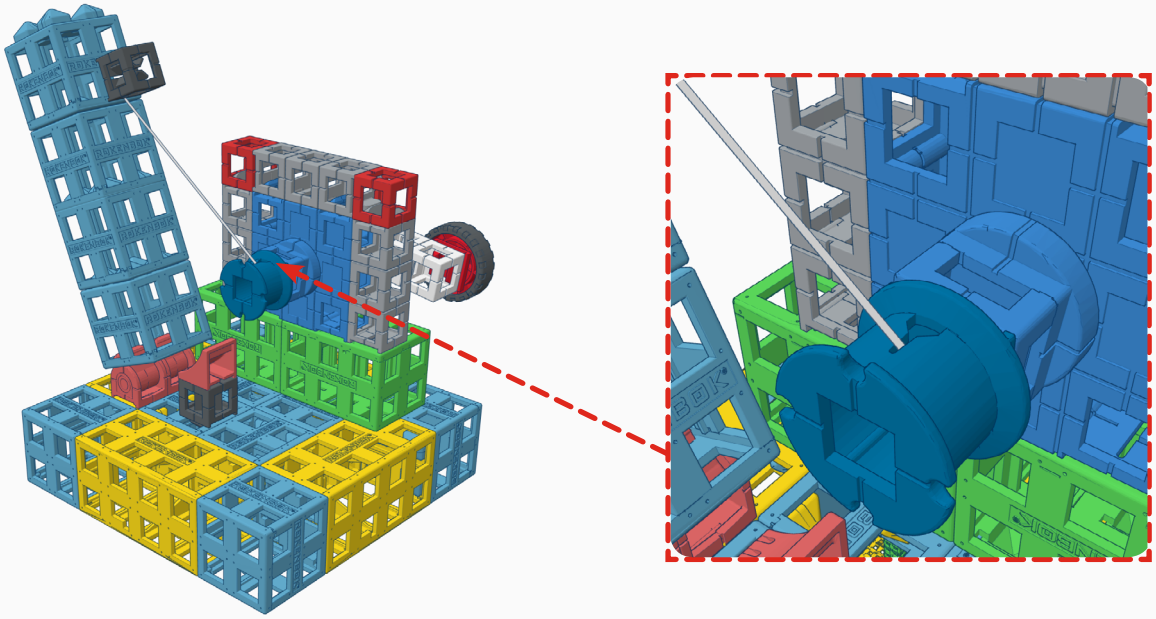
Push Pull Rod

The cog fits into the opening of a beam or half beam and can change rotary motion into back and forth linear motion. This allows for push/pull design applications. In this example, a cog has been snapped into a bearing module to move a beam back and forth.

Snap-in Spool

The snap-in spool is a small wheel that can be used for winding or unwinding string in a design. It is usually used in conjuction with the bearing module. Review the following example, then complete the STEM-Maker Build listed below.





Example: Crane

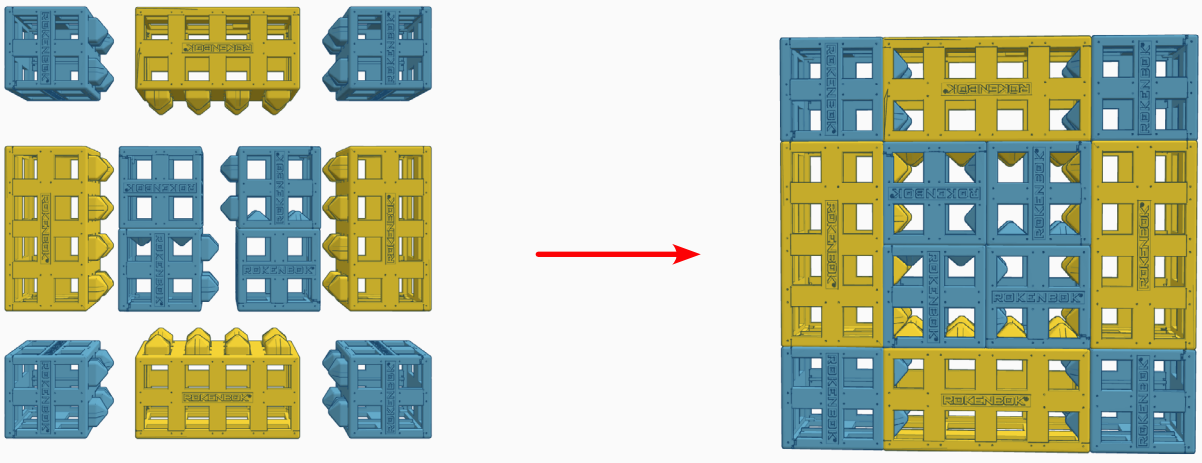
In this example, a snap-in spool has been connected to one side of a bearing module, and a crank handle has been connected to the other side. The body of the bearing module is firmly attached to the structure. As the crank handle is turned, power is transferred through the body of the bearing module and to the spool. As the spool rotates, string winds or unwinds to raise or lower the crane.

STEM-Maker Build: Complete the step-by-step instructions on the following pages, to assemble a crane.

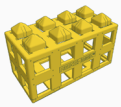
STEM-Maker Build: Crane

Complete the step-by-step instructions to build a crane.

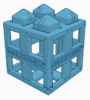
1



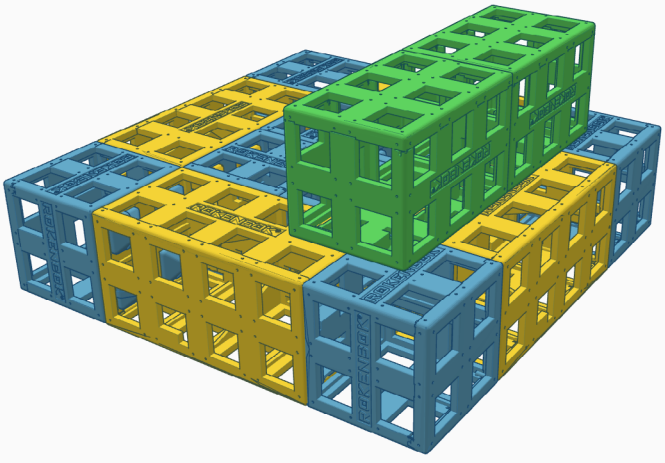
4x
Yellow ROK Block



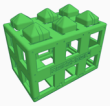
8x
Blue ROK Block



2



2x
Green ROK Block



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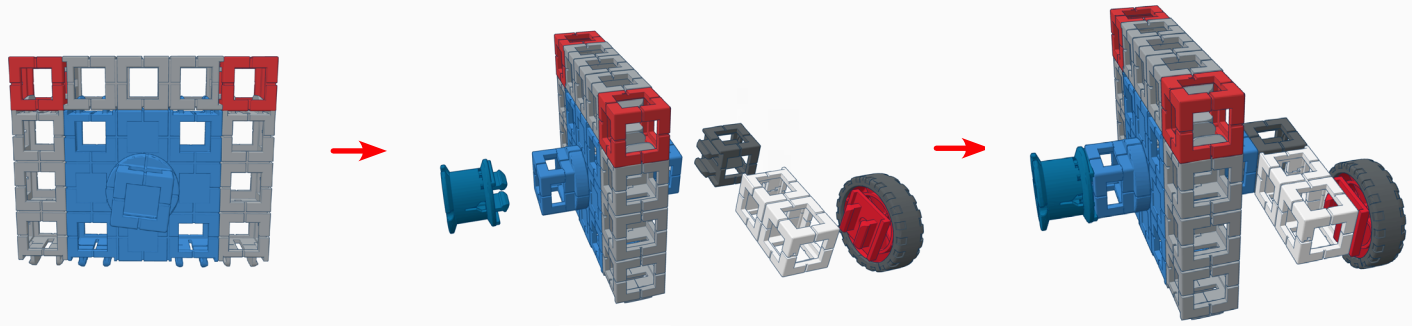
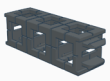
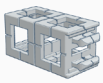
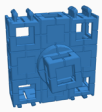


2x Block	3x Half Beam	1x Single Snap Block	1x Riser	1x Snap-In Wheel	1x Spool	1x Bearing Module
						

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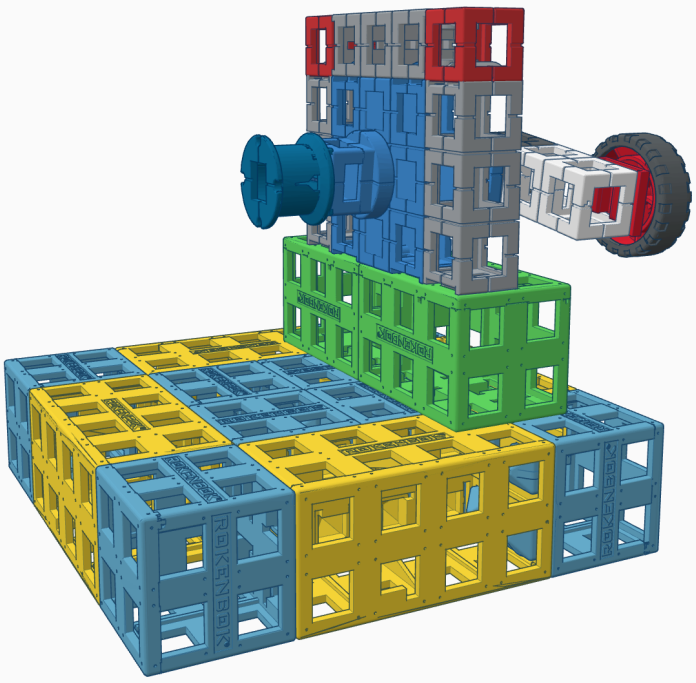

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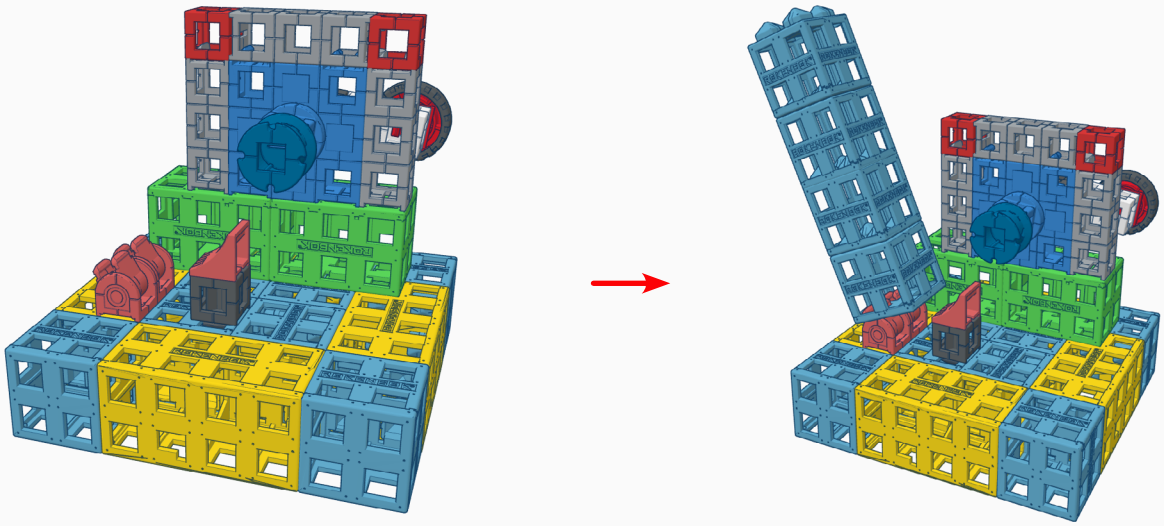
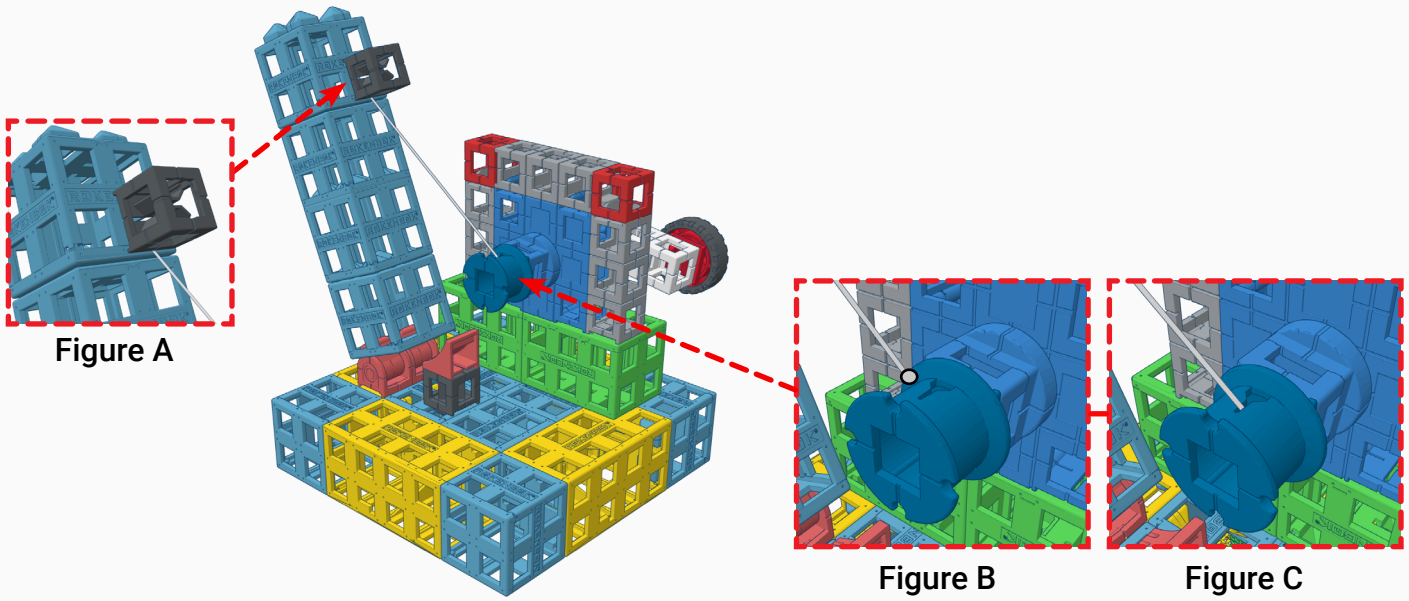


2x Hinge Block	4x Blue ROK Block	1x Single Snap Block	1x Corbel

6

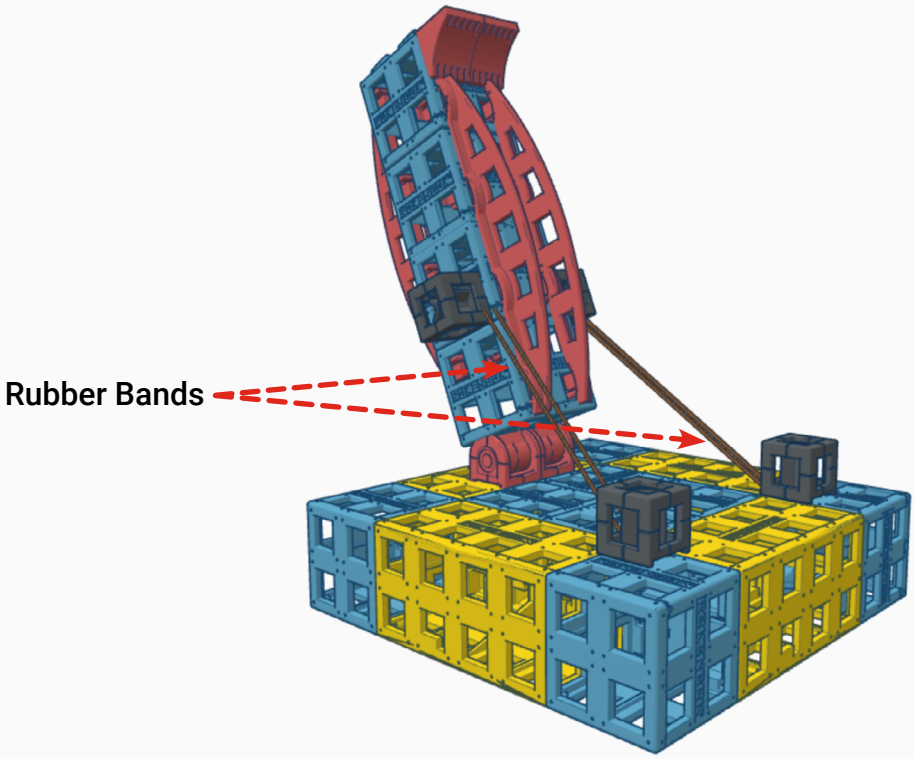


1x
Single Snap Block

Crane:
Cut a piece of string that is 28cm long. Connect one end of the string to the crane arm using a single snap block as shown in **Figure A**. Tie a knot in the other end of the string and attach it to the slot in the spool as shown in **Figures B** and **C**. Turn the crank to raise and lower the boom on the crane.

Rubber Bands

One of the handiest engineering materials included in the ROK Blocks Lab are rubber bands. They can provide energy and resistance in a design to make it work correctly. Review the following example, then complete the design challenge listed below.



Example: Catapult
In this example, rubber bands have been attached to a catapult arm and allow the catapult to propel objects forward.

Design Challenge: Design and engineer a catapult or launching device. It can be similar to the example shown above, or it can be a new design. Make sure to include a rubber band in the design.

Cleanup

To keep the ROK Blocks Lab clean and organized, students should have an understanding of how to correctly pack the lab once they are finished using it. Locate the ROK Blocks Inventory and Organization Guide that was included in the lab. Pack the lab back exactly as it shows in the guide.