

Introduction

In this lesson, students will learn how to use various engineering materials and construction techniques to make structures that are strong and stable.

[Click here](#) to explore the entire Kid Spark Curriculum Library.

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 different techniques used to build a strong structure.
-  Understand how different engineering materials can be used to add stability to a design.
-  Use Kid Spark engineering materials to complete a series of design challenges.
-  Become comfortable in the ability to design and engineer projects that are strong and reliable.

Resources

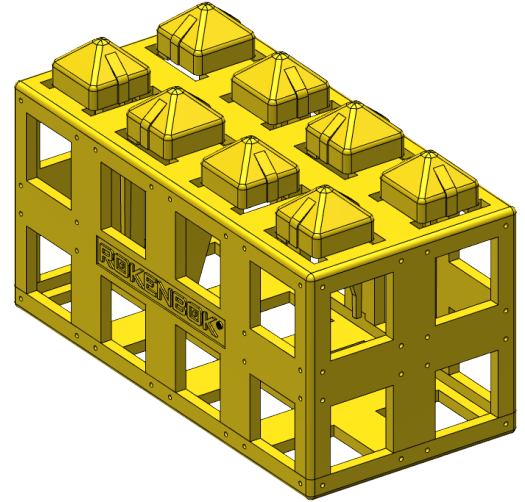
The following resources will be used to complete this lesson.

1. Kid Spark Curriculum

Making Things Strong
a. Curriculum Packet

2. Kid Spark Mobile STEM Lab (Pictured Right)

Activity Time: 60 Minutes



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



ROK Blocks Mobile STEM Lab

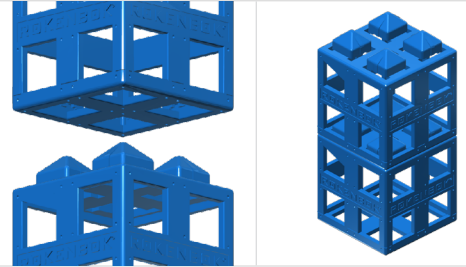
*Up to 4 students per lab

Building Basics

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

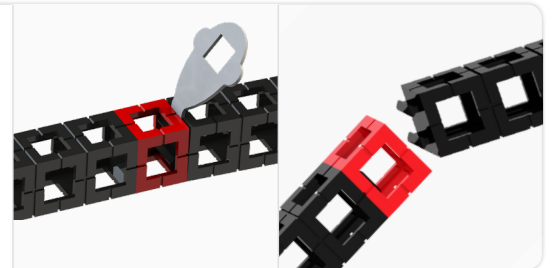
Connecting/Separating ROK Blocks:

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



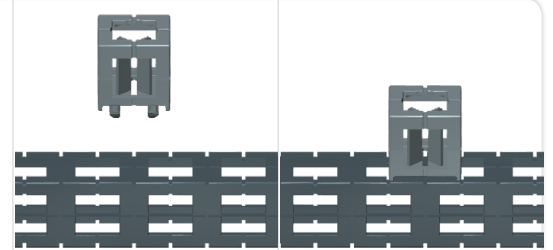
Connecting/Disconnect Smaller Engineering Materials:

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.



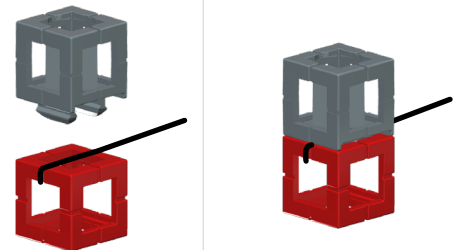
Snapping Across Openings:

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.



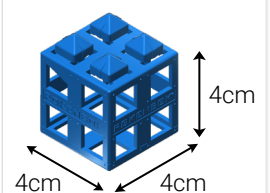
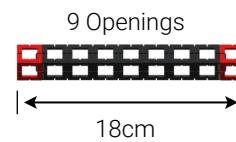
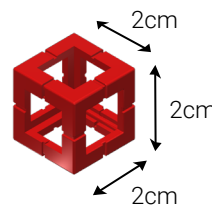
Attaching String:

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.

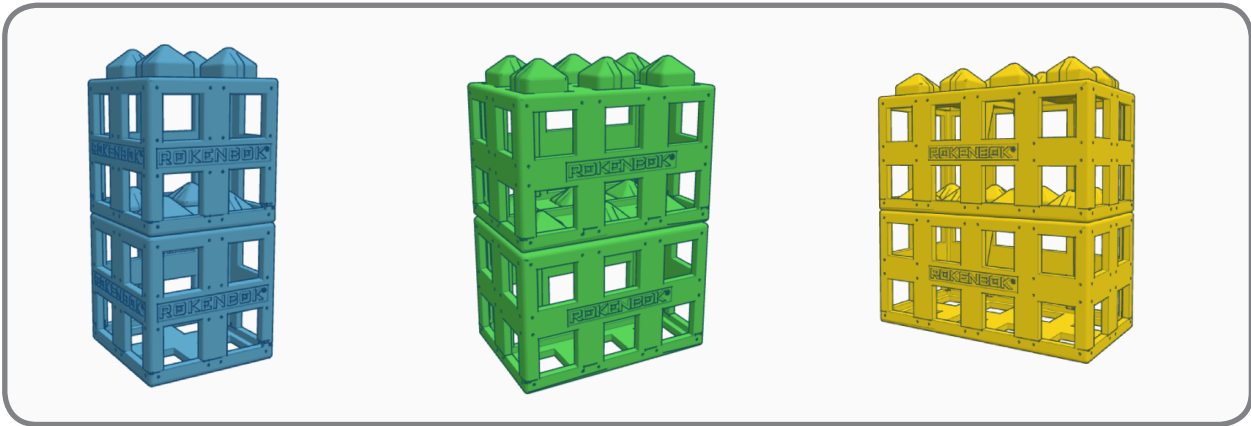


Construction Technique - Vertical & Bridge Stacking

Design engineers understand how structures can be made strong and safe. Simple techniques, such as “stacking” blocks in a certain configuration will make them stronger and safer to use. Projects can be assembled in many different ways, but if not done correctly, they will be weak and won’t work well. Review and practice the following stacking techniques. After becoming familiar with each technique, complete the design challenge listed below.

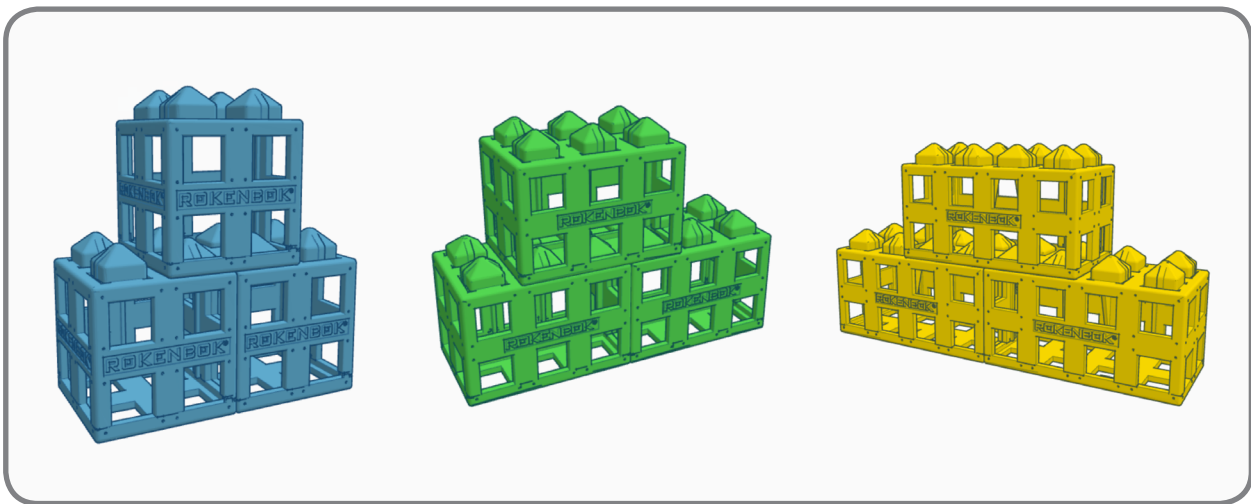
Vertical Stacking

With this method, blocks are stacked vertically right on top of each other. This is an easy way to stack blocks, but is not very strong and has a limited application.



Bridge Stacking

This method of stacking has proven to be a very strong and easy way to connect blocks together. Two lower blocks are “bridged” by a third block that connects all three blocks. This is a great way to connect blocks for walls and other structures.



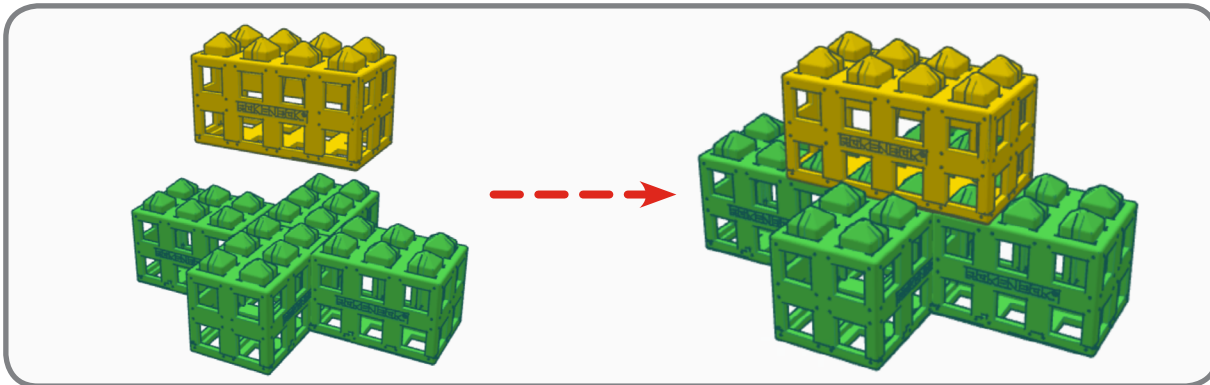
Design Challenge: Build two structures that are at least 20 cm in height. One structure should be built using the vertical stacking technique and the other using the bridge stacking technique. After the team is finished building, determine which structure is stronger and more stable.

Construction Technique - Cross Lap & Free Form Stacking

Design engineers who build structures are called “Structural Engineers.” Engineers who design machines are called “Mechanical Engineers.” It is important to become familiar with how to add stability to a design so it will function consistently. Review and practice the following stacking techniques. After becoming familiar with each technique, complete the design challenge listed below.

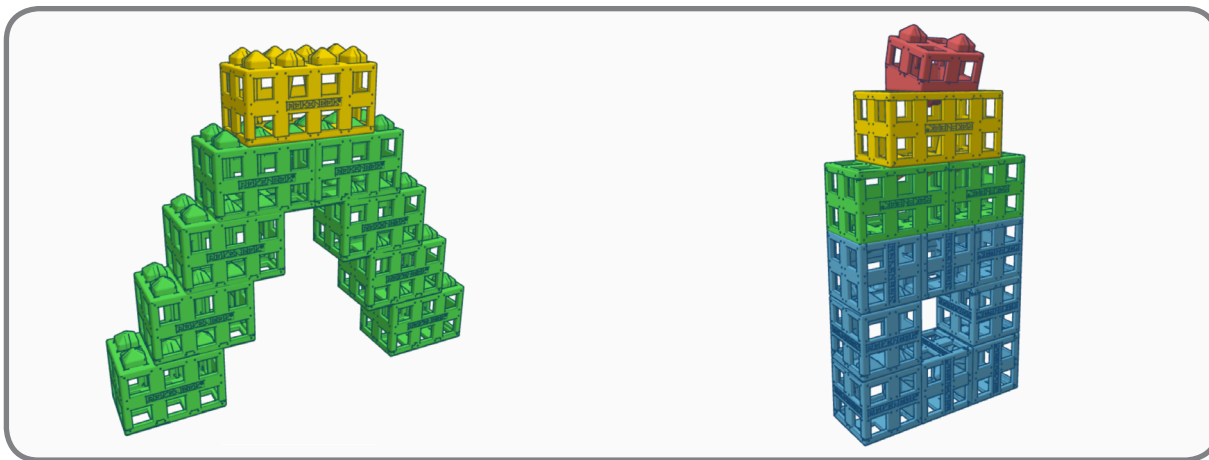
Cross Lap

Similar to bridge stacking, ROK Blocks are “lapped” across lower blocks at a 90° angle. The overlapped joint makes the wall structure strong and makes designing structures easy and fun.



Free Form

ROK Blocks can be stacked in a variety of ways. Sometimes blocks are freely stacked in order to build a specific design. Free form stacking doesn't always follow a specific order and can include multiple techniques.



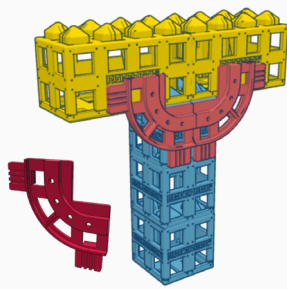
Design Challenge: Build two structures that are at least 25 cm in height, using the cross lap and free form stacking techniques.

Construction Technique - Bracing & Support Components

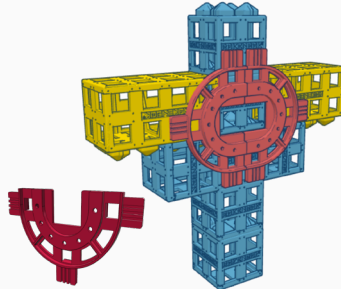
One of the easiest ways to make a structure strong is to add bracing or support materials. The ROK Blocks Lab includes braces, girders, and other support materials that can be used to add strength and stability to a design or structure. Review and practice the following stacking techniques. After becoming familiar with each technique, complete the design challenge listed below.

Bracing

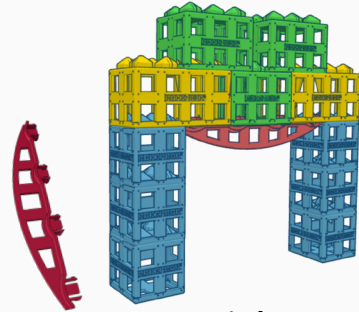
Two way and three way braces are designed to snap across the 90 degree corners of a structure to make it very strong. Girders are designed to snap into openings across a span. They can be placed under the span or across the front for strength.



Two Way Brace



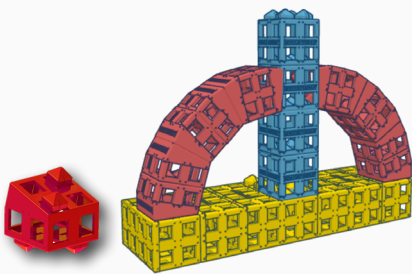
Three Way Brace



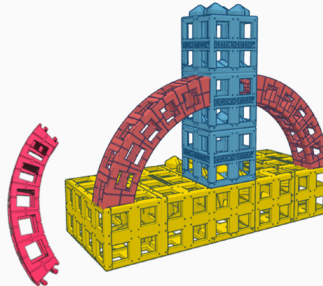
Girder

Support Materials

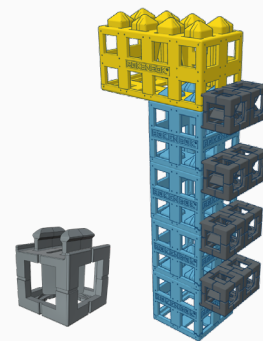
There are many ways to use the engineering materials in the ROK Blocks Lab to add strength to a design. The Red ROK Blocks or curved beams can be used to add support to a structure. Also, using any block with tabs to snap across openings is an easy way to reinforce a weak joint in a structure.



Red ROK Blocks



Curved Beams



Single Snap Blocks

Design Challenge: Build two structures that are at least 30 cm in height. One structure should feature bracing components (Two Way Brace, Three Way Brace, or Girder). The second structure should feature other support materials that are strategically placed to increase structural stability in the design (Red ROK Blocks, Curved Beams, or any component with tabs used to snap across openings).

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.




See Like a Designer,
Think Like an Engineer

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





ROK BLOCKS

IMPORTANT: Teachers, please register your Mobile STEM Lab online at RokenbokEducation.org/Register

INVENTORY & ORGANIZATION GUIDE



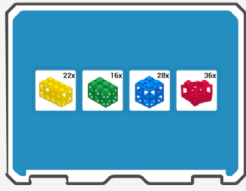
Bill of Materials

 Storage Case	1x	 Blue ROK Block	28x	 Green ROK Block	16x	 Yellow ROK Block	22x	 Red ROK Block	36x	 Block	8x	 Single Snap Block	8x
 Double Snap Block	4x	 Riser	8x	 Half Beam	4x	 Beam	4x	 Mini Curved Beam	4x	 Small Curved Beam	4x	 Gear Teeth	44x
 Corbel	16x	 Trailer Hitch	4x	 Axle Block	8x	 Hinge Block	10x	 Snap-in Wheel	20x	 Girder	4x	 3-Way Brace	4x
 2-Way Brace	4x	 Bearing Module	4x	 Snap-in Cog	1x	 Snap-in Spool	1x	 Snap-in Seat	1x	 Roadway Incline	8x	 Roadway Straight	2x
 Roadway Entry	4x	 Box	2x	 Box Hack	2x	 Curved Window	2x	 ROK Worker II	2x	 ROK Worker I	2x	 String	1x
 Rubber Band	6x	 Tool	2x										

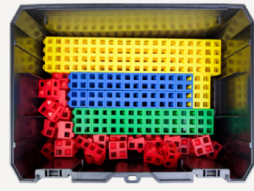
WARNING:
CHOKING HAZARD.
Toy contains small parts and small balls. Not for children under 3 years.

Unpack, Organize & Store | Use the following guide to correctly organize the ROK Blocks student module.


BOTTOM OF MODULE



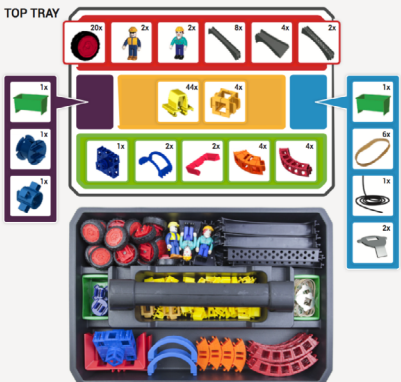
ROK Block rows are 2 blocks deep.



MESH SACKS
Place mesh sacks underneath top tray.



TOP TRAY



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