

Overview:

In this lesson, students will learn how to think like an engineer. Students will explore patterns and symmetry as they build different structures and designs.

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Unit Concepts & NGSS Alignment:

- Manipulate ROK Blocks to build increasingly complicated structures
- Explore what engineering is and what engineers do
- Compare and contrast size and shape of objects
- Match 3-dimensional objects to 2-dimensional pictures
- Create and analyze patterns
- Recognize symmetry

Scientific/Engineering Practice - Analyzing and interpreting data
Crosscutting Concept - Patterns

Lesson Introduction:

Instructor: "Today we are going to learn how to think like an engineer. Engineers love patterns. Patterns are things that repeat. We can make a pattern with clapping." Clap a simple pattern like slow, fast-fast, slow, fast-fast. Have the students repeat after you. Then change the pattern, like slow, slow, fast-fast-fast, slow, slow, fast-fast-fast. Discuss with students how patterns are all around us. Ask students to point out patterns they see in the classroom. If they're having difficulty, point out some patterns for them (like patterns on the wall, ceiling, etc.)

Core Learning Activity:

1. Give each team of two students a Patterns & Pyramids Construction Mat and the correct assortment of engineering materials listed above.
2. Inform students that we can make patterns with ROK Blocks. Instruct all students to locate (2) Blue ROK Blocks, (2) Green ROK Blocks, and (2) Yellow ROK Blocks. **Instructor: "Let's make a repeating pattern."**
3. Demonstrate making a pattern on a table in front of you with the pyramid side up and without connecting them. Make the pattern: blue, green, yellow; blue, green, yellow. **Instructor: As you place the blocks say: "I'm putting the blocks down in this sequence: blue, green, yellow. A sequence tells us the order of a pattern. It tells us what comes first, and second, and next."**
4. Instruct the students to copy your pattern. Ask them to share what they notice about the pattern by using these prompt questions:
 - a. What else do you notice about this sequence? (**It goes small, medium, large. Four pyramids, six pyramids, eight pyramids.**)
 - b. Can you make a different pattern with these 6 blocks? (**Such as B, B, G, G, Y, Y**). Ask students to talk you through their pattern.

Activity Time:

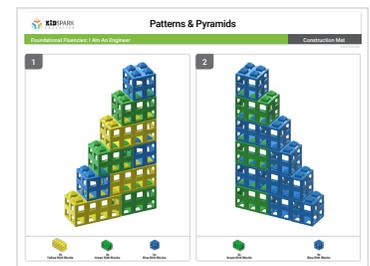
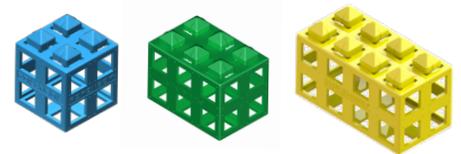
30 - 40 Minutes

Kid Spark Mobile STEM Lab:

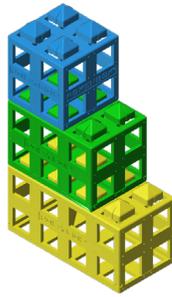
ROK Blocks

Materials Per Team:

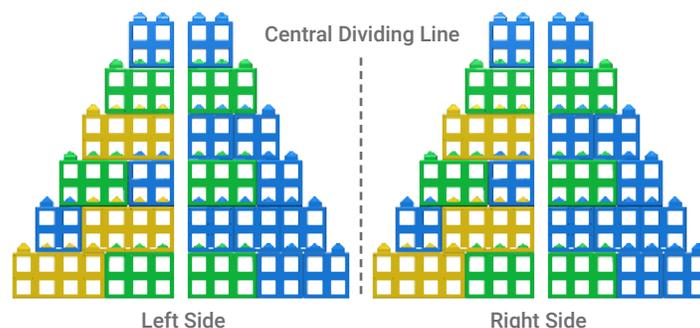
- Group students in teams of 2.
- 12 Blue ROK Blocks
 - 6 Green ROK Blocks
 - 4 Yellow ROK Blocks
 - 1 Construction Mat



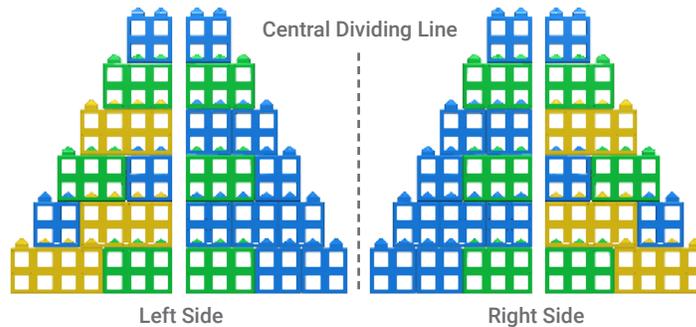
5. Instruct students to put aside, for now, all but (1) Blue, (1) Green, and (1) Yellow ROK Block and have them work in pairs. Instruct students to assemble a pyramid as shown in the image below.



6. Have students locate the Patterns & Pyramids Construction Mat. Show students how they have built the top part of the pyramid shown in Step 1. Demonstrate how to add the next layer (Green ROK Block and Blue ROK Block) to the pyramid. Demonstrate the next two layers as they build, providing support as needed. Instruct students to stop after they have finished Step 1 on the construction mat.
7. **Instructor: "At this point we have built half of the pyramid. Let's build the other half, but this time, we will only use Blue and Green ROK Blocks."**
8. Instruct the students to follow Step 2 on the construction mat to build the other half. This time, instruct students to only use Blue and Green ROK Blocks. Demonstrate and provide support as needed. When both sides are built, stand them next to each other with the tall sides together.
9. Instruct students to share what they notice about the two sides of the pyramid. Use the following prompt questions to initiate discussion:
- How are the sides the same? (**Same size/shape**)
 - How are they different? (**Different block colors, different number of blocks**)
 - How is it possible that the two sides are the same size but use a different number of blocks? (**Yellow ROK Blocks are twice as big as Blue ROK Blocks**)
 - Instructor:** "Walk" your fingers up the angled side of the pyramid and ask the students what it reminds them of? (**Stairs**)
10. **Instructor, "Sometimes patterns can be symmetrical. Does anyone know what symmetrical means? A shape or pattern is symmetrical if a central dividing line (a mirror line) can be drawn on it, to show that both sides are exactly the same (or mirror each other).** Instruct teams to pair up with another team and place their pyramids next to each other to create a pattern (as shown below). Ask students if this pattern is symmetrical. (This pattern is not-symmetrical because the left side does not mirror the right side.)



12. **Instructor:** “Now lets make a pattern with our pyramids that is symmetrical.” Instruct teams to re-arrange the different sides of the pyramids so that the pattern is symmetrical (see image below). Give teams a few minutes to try and re-arrange their pyramids so they are symmetrical. Help students if necessary. Point out to students how this pattern is symmetrical because the left side and the right side mirror each other.



13. Have teams return to their work areas with their original pyramids. Instruct students to go ahead and break down the pyramids. If time permits, teams can try to complete the lesson challenge listed below.

Lesson Challenge: Build a Custom Pyramid

Instructions: Challenge teams to build a custom, symmetrical pyramid using the provided materials for this lesson (see example solution below).

