PROJECT #1

Super Cuffs

Has your child ever seen a superhero movie or read a superhero comic? Superheroes have extraordinary powers and dedicate their lives to protecting humankind. Yet, even with all their super powers, superheroes still need protection.

In this activity, your child will take on the role of a structural engineer. Structural engineers use shapes to add strength and stability to buildings, roads, and a variety of products. Your child's mission is to create a powerful wrist cuff by using a repeating pattern of shapes. The cuffs have to be strong enough to support the weight of a stack of books.

MATERIALS

- Straws
- Scissors
- Tape, hot glue, or other bonding material
- Soup can
- 4 heavy books

CHALLENGE

Construct a wrist cuff (using only straws and tape) that:

- Can withstand the weight of four heavy books
- Fits around your wrist

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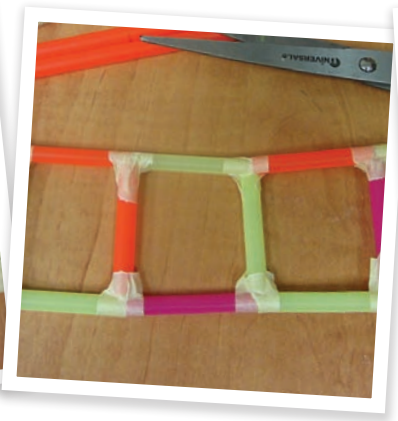
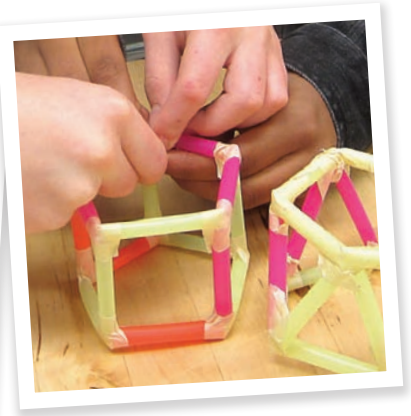




DIRECTIONS

1. **Look over the materials and ask your child:**
   - Where can you see shapes that support a lot of weight?
   - Which shapes (such as squares or triangles) do you think are the strongest? Why?

2. **Cut straws into two-inch pieces.**

3. **Create two wrist cuffs**, one out of squares and one out of triangles, by using straws to make the patterns shown above. Use a soup can as a template for creating the cuff shape, wrapping the cuff around the can as you build it.

4. **Test the strength of the cuffs** by placing a book directly on top of each, adding one book at a time. Examine your cuffs after you add each book.

5. **Assess the strength of each cuff:**
   - How much weight did each cuff support?
   - Were there weak points in your cuff?
   - Which shape was stronger?
   - What could you do to make your next set of cuffs stronger?
   - Why would it be important for superheroes to have strong cuffs?
   - Where else might you see "strong" shapes?

6. **Redesign a new, stronger cuff** using what you learned from your previous two designs.

MORE ABOUT
Structural Engineering

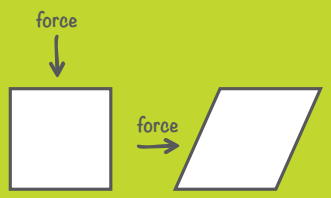
Starting Salary:
$55,000

Structural engineers design load-bearing structures for buildings, bridges, and roadways. They are responsible for making sure that structures are strong and can withstand earthquakes and other natural disasters.

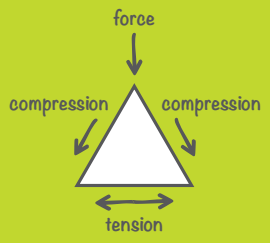
SCIENCE
BACKGROUND

Force is a push or a pull on an object. For example, when you push on a door to close it, you are exerting force on it.

A structure's shape determines its strength. For example:



Squares:
When force is placed on one side of a square, that force may shift the corners (angles) of the square. This changes the shape of the square, making it unstable.



Triangles:
When force is placed on top of a triangle, that force is equally distributed to both sides (compression) and pushes on the bottom side (tension). This distribution of force is what gives triangles their strength.

OUT AND ABOUT

Go on a shape scavenger hunt!

When you're out in your community, see if you can find shapes in larger structures, such as houses, bridges, and playgrounds. Which shapes do you see? What roles do they play in structures?

FOR YOUNGER KIDS

- Provide a template of each structure for your child to follow.

FOR OLDER KIDS

- Experiment with using different shapes, such as rectangles, hexagons, or octagons.
- Try creating cuffs with multiple layers.

ADDITIONAL RESOURCES

- Check out PBS's Building Big: Shapes lab to find out more about how shapes are used to strengthen structures pbs.org/wgbh/buildingbig/lab/shapes.html
- Want to try another activity to test the strength of different shapes? Head over to Zoom! pbskids.org/zoom/activities/sci/strongestshape.html
- Put squares and triangles to the test in this Strong Shapes activity thinkingfountain.org/s/strongshapes/strongshapes.html