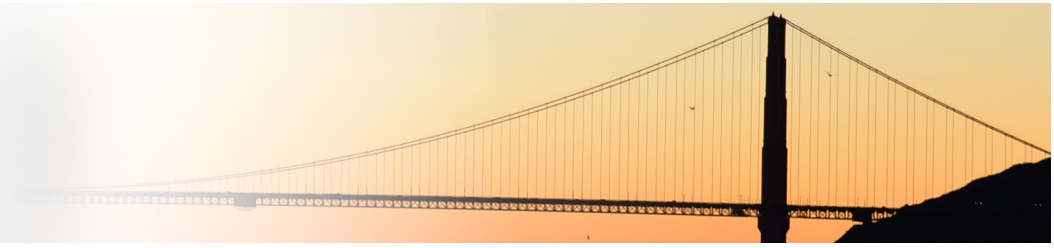


The Messy Meter

Building Bridges

This activity was developed by Arianna Smith, a 4-H teen leader in STEM, in collaboration with the University of Tennessee. In this activity, kids will learn about the engineering design process and the basic mechanics behind building bridges while designing their own bridge!

Recommended Grades:
Grades 6-8, 9-12

Estimated Time:
45 minutes

Subject:
Engineering

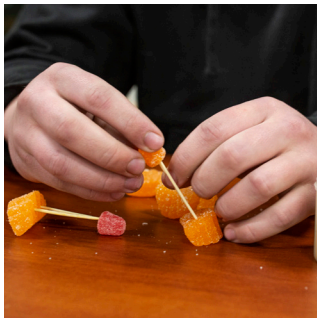
WHAT YOU'LL NEED

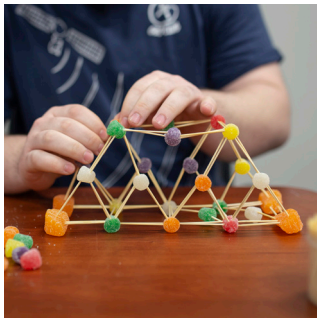
PANTRY STAPLES:

- 100 toothpicks
- 4-8 books

SPECIALTY SUPPLIES:

- Gummy candies (gumdrops and orange slices work well)





STEPS

Use the below steps to get started, but don't forget to let kids experiment.

1. Start by asking the kids, "How many of you had to cross a bridge to get to school in the morning? Have you ever thought of what would happen if all the bridges were closed?
2. Take a look at the pictures in the Lab Notebook of three of the most common bridge types. Spend 2-3 minutes discussing how the bridge design may contribute to the purpose of bridges - supporting weight. Look at the similarities between the bridge types and discuss why these choices might be the most common.
3. Have kids sketch out a design for their own bridge on paper and share why they made certain design decisions with you.
4. Now get building using the toothpicks and the gummy candies! The goal is to build a bridge that can hold the maximum weight possible and the final structure must be portable! *For older youth, check out the bonus fun.
5. Once everyone has finished their designs, place the bridges so that they span the gap between a stack of books or between tables.
6. Place one book at a time onto the bridges to see how much weight they can withstand. If comparing two or more bridges, be sure to use the books in the same order.
7. Show kids the graph of the engineering design process in the Lab notebook and recap each of the steps they did in this activity, explain that they just followed the same steps real engineers use when creating bridges!

Bonus Fun:
Challenge older youth to complete their bridge(s) using different requirements, such as only 25 toothpicks, in 15 minutes, or so they can hold 5 books!

Questions to Engage Youth:

- After testing your bridge, what would you change about your design?
- What are some things you learned about the engineering design process?
- In what ways can you use the engineering design process in your life?

Explanation:

Bridges have been built for centuries utilizing many different designs, but they all have one thing in common. In order to not fall down, the bridge must balance two different kinds of force: compression (a pushing or squeezing force, acting inward) and tension (a pulling or stretching force, acting outward). By balancing these forces, bridges channel the weight or load of the bridge onto the main supports. By balancing these two forces there is no overall force to cause motion and do damage.

So how do you know which style bridge to build? There are lots of factors to consider, but the main one is how far the bridge needs to stretch. A very short span, such as over a small river, would likely use a beam or truss bridge. While a suspension or cable-stayed bridge could be used, they are more complex and expensive, and would require much more support than would be needed.

Brought to you by:

NATIONAL 4-H COUNCIL

UTEXTENSION INSTITUTE OF AGRICULTURE THE UNIVERSITY OF TENNESSEE

HughesNet®

Find this and other great STEM activities at **Shop4-H.org/STEM**

Lab Notebook

Arch Bridge

A bridge with connections at each end that is shaped like a curved arch.

Stari Most bridge, Bosnia and Herzegovina

Truss Bridge

A bridge whose structure is supported by combined elements that form triangular units.

Baltimore, Maryland

Suspension Bridge

A bridge in which the weight is supported by cables that are connected to towers.

Golden Gate Bridge, California