LESSON 12:
TASTY TOWER

SUPPLIES

TEACHER BRINGS
- 2 bags mini marshmallows

PENCIL BOX
- Rulers

MAIN BIN
- Paper Plates (20)
- Toothpicks (300)
- Clorox wipes

OBJECTIVES

- [x] Explore which shapes are the most stable or structurally sound
- [x] Understand the difference between tension and compression

HOOK

1-2 min

Has anyone ever told you not to play with your food?

In today's experiment, we will be using food to construct a strong tower, just like an engineer. Rather than steel, concrete, or other building materials, we will be using toothpicks as our rigid material, and marshmallows as the sticky material that allows our toothpicks to stay together.

Our structures will need to be strong, so we need to think about ways to make sure the tasty tower doesn't fall over!

INTRODUCTION

1-3 min

Before we start today's building challenge, demonstrate building a cube out of toothpicks and food, and then try building a pyramid. Which seems stronger: the structure made of squares, or the structure made of triangles?

Some shapes are stronger others. Triangular shapes are especially strong, because triangles are cross-braced, which means all the weight can be supported from a single point on the top. Triangles support top and side loads much better than a square or rectangle.

Engineers are always trying to build strong structures in the easiest way possible. When designing bridges, buildings, and so on, knowing which shapes are the strongest results in structures that can hold more weight and remain more stable. The materials used in an engineering project is also something that needs to be considered: the cost, strength, flexibility, and availability of certain materials are all very important considerations. For today's project, we will use marshmallows and toothpicks. Are these good building materials?

TASTY TOWER

ACTIVITY

20 - 25 min

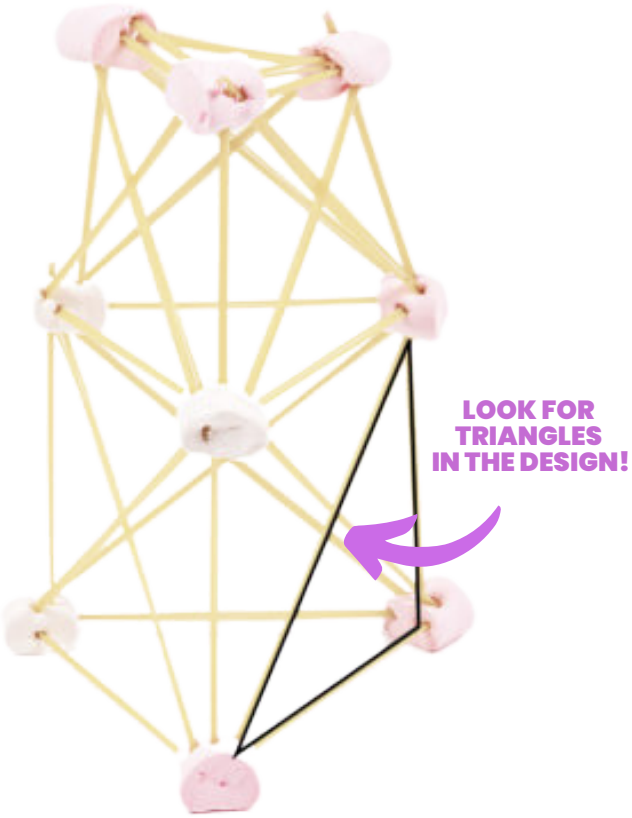
1. The goal of this experiment is to build the tallest structure! The catch: your tower needs to stand up on its own for 10 seconds without falling over.

2. Pass out toothpicks and marshmallows on paper plates. Students can work individually or in groups of 2.

3. Encourage students to build their towers! Remind students that starting with a pyramid will be the best way to build a tower that is strong. Provide assistance as needed.

4. Once everyone has completed a tower, measure the height, and then let it stand on its own for 10 seconds. If the towers did not stand up without falling, it is time to revisit designs! Ask students: what could you have done to make it stronger?

5. When students are done building, have them wash their hands and clean up the tables!



EVALUATE & REDESIGN

10 min

When creating towers, the design phase is important, and all architects and engineers spend lots of time figuring out what they are going to build and how they are going to build it before even starting construction. What would happen if an architect designed a building that can't support its own weight? What about a bridge that can't hold the weight of cars driving across it? Are these strong, or are they not worth building in the first place?

toothpicks are thin, and cannot hold much tension or compression, so they break very easily. Marshmallows handle compression well, but do not hold up to tension. What happens when we use them together?

REMINDER: Student's structures may shift and their towers may topple. Remind students that no engineer gets it right the first time—that's why engineers have a design phase. No marshmallow and toothpick tower will remain standing forever!

TASTY TOWER

OBSERVE & EXPLAIN 3 min

Ask students to think about their designs:

- What design allowed your tower to stand for 10 seconds?
- Which shapes are the best at holding weight and remaining stable? Can you find any triangles hiding in your tower?

CONCLUSION 3 min

Conclude by discussing with the students that today, we thought like engineers to create tower. We went through the following stages to make our designs the best they could be:

- Brainstorming, Designing, Building, Testing, Evaluating, & Redesigning

Can students explain in their own words what they learned during the experiment?

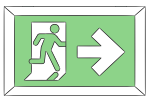
If students were building a real tower, would they want to use marshmallows and toothpicks? Why are these not good materials to build with in the real world?

MOVEMENT BREAK

The Short Toothpick

Place a paper plate in front of each group of students. Break a small piece of the end off a toothpick, and add the long section of that toothpick to the plate. Then, add a handful of unaltered toothpicks to the plate, making sure the kids close their eyes while you do so. Provide a similar plate full of toothpicks to each table, and then have students race to see whch group can find the shorter toothpick first!

This activity requires observation and patience--because the toothpicks look the same with the exception of one small difference, students will need to check each toothpick carefully.



Exit Ticket

Ask students the following question as they walk out the door.

- Q: What is the strongest shape?
  - A: Triangle