Right on Target: Engineering a Catapult

What is engineering?

The word "engineering" comes from the Latin word that means "cleverness." Engineering means solving a problem by using science, math, and common knowledge. People use engineering to design and create things or processes that are useful. Anyone who likes to explore and build things can learn how to engineer designs of new creations.

Different Engineering Jobs

The term engineering is very broad! There are in fact many types of engineers that have different roles and tasks. Here are just a few!

- A civil engineer designs and builds buildings, roads, and bridges.
- A mechanical engineer works to design mechanical systems, tools, and machines.
- An electrical engineer knows all about electricity, which makes it possible to design circuits and computer chips.
- Chemical engineers are special scientists who work with raw materials and chemicals.

Engineer Design Process

There are certain steps an engineer has to take to create their product!

1) Ask to find what the need of the product is
2) Research the problem
3) Imagine possible solutions
4) Plan by picking one of the solutions
5) Create a beginning model of the product
6) Test the model
7) Improve and redesign if needed

So now the fun part...we are going to test out the design steps through building a catapult! There are going to be steps listed below on how to create a certain type of catapult, but you are free to change it! Try using different materials or a different shape and see how this changes how it works. Let's begin!

Important Note: If you need any more help creating the catapult use these YouTube links.

https://youtu.be/_ZqzZ7lUAz8

https://youtu.be/WpLFC_SOpXs

Step-by-Step Guide

Possible Goals

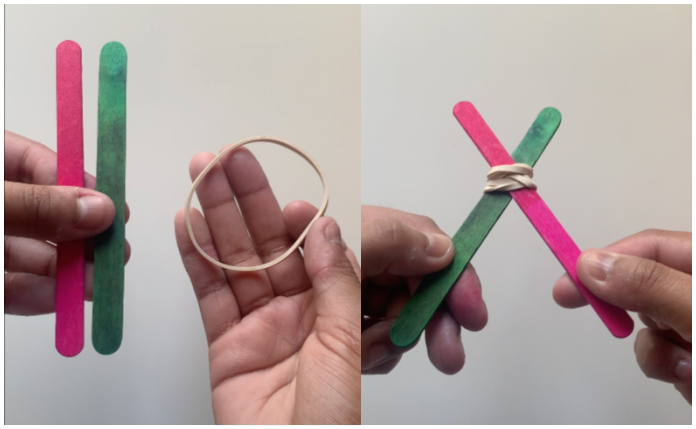
- The farthest the object can land
- If the object can land in a paper cup
- If the object can knock down a tower of cups
- If an object can hit the bullseye on a target

Materials

- 11 Popsicle sticks (could use pencils or stir sticks)
- 16 Rubber bands (could use hair ties)
- Bottle cap
- Tape/hot glue
- Small ball (any object to launch from your catapult)

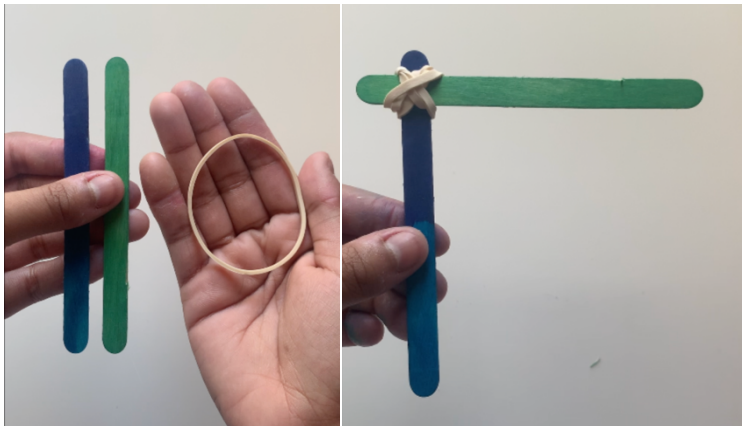
Procedure

Step 1: Using two of the popsicle sticks, cross them over each other one-third of the way down. Then, tie a rubber band horizontally across the point where the sticks meet.

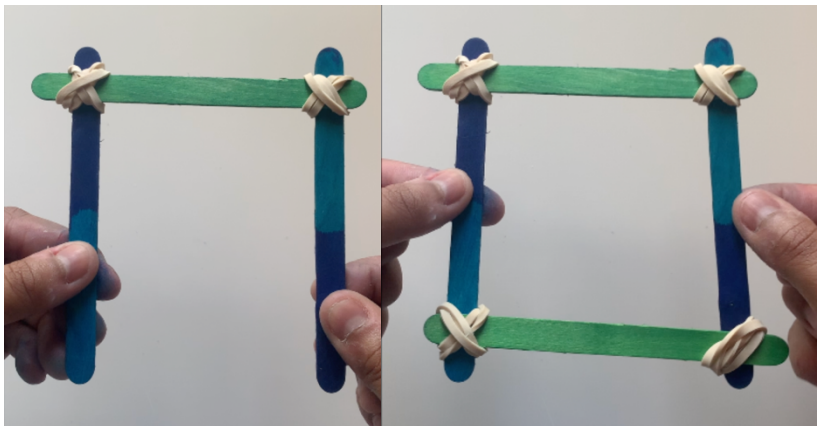


Step 2: Repeat Step 1 with two more popsicle sticks and a rubber band. Set both pieces made off to the side.

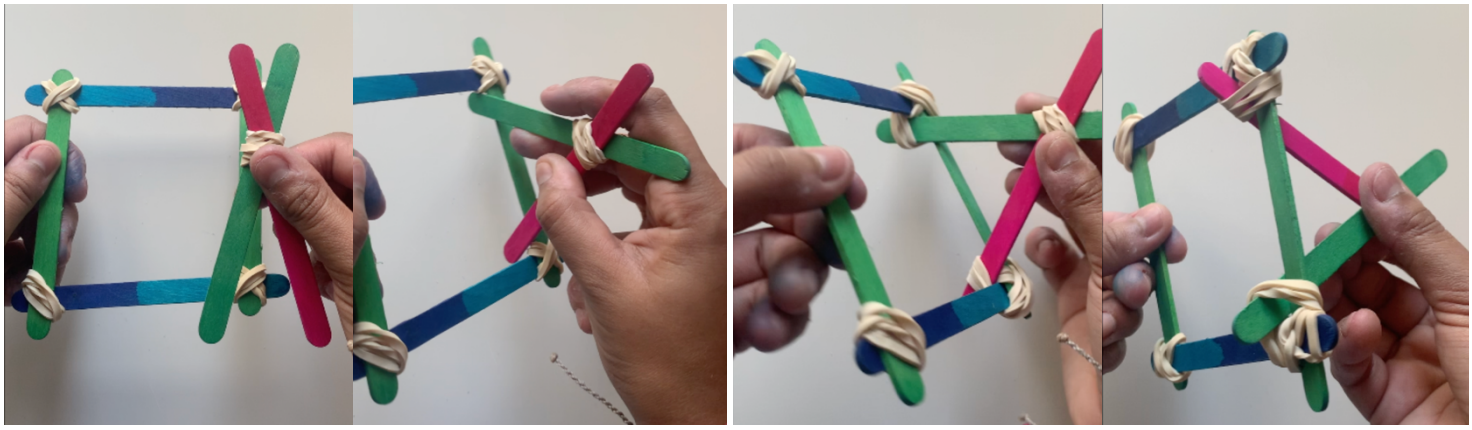
Step 3: Using two popsicle sticks, cross the two ends together at a perpendicular angle (90°). Tie a rubber band across the point where they meet (make sure that you cross over the rubber band multiple times in different directions to keep it secure).



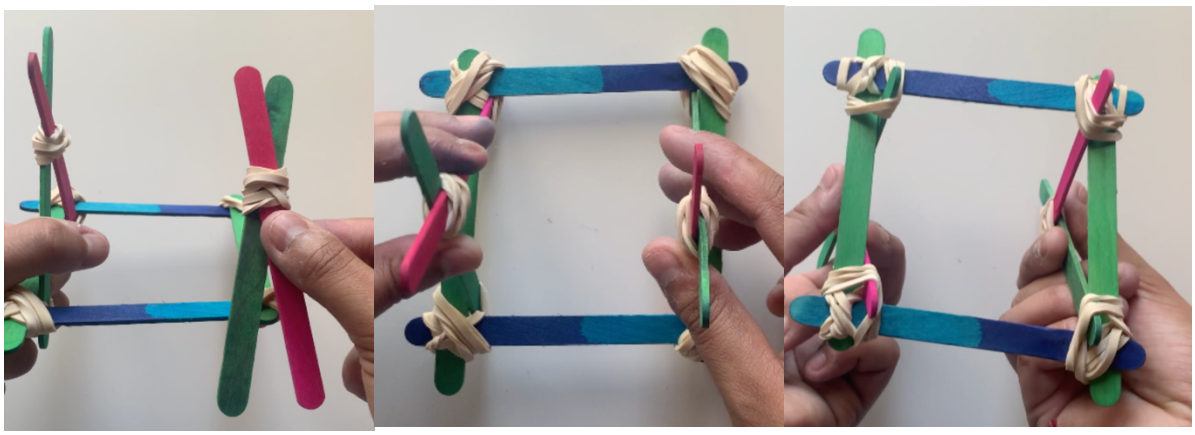
Step 4: Repeat Step 3 at each of the other three corners with two more popsicle sticks and three rubber bands to create a square.



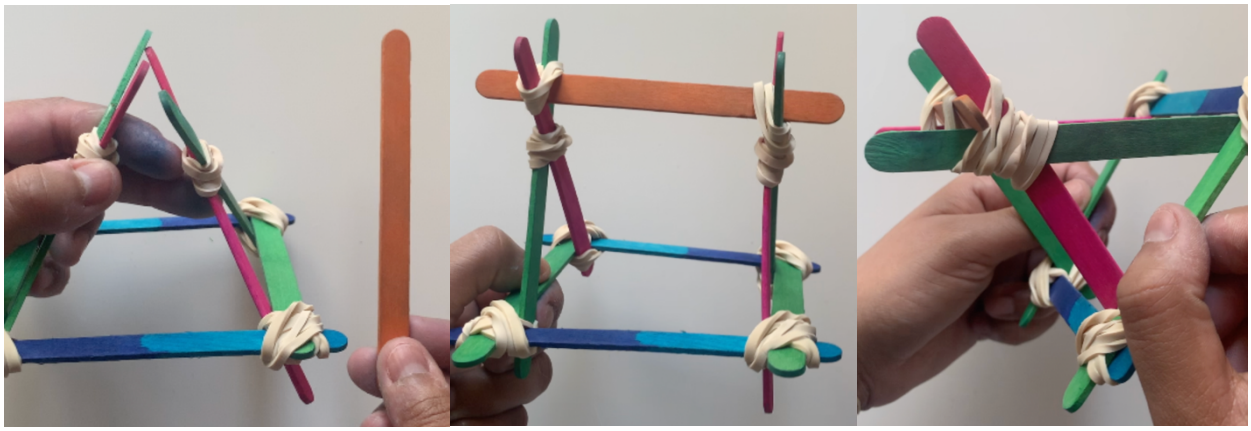
Step 5: Using one of the crossed popsicle stick pieces made earlier place it vertically on the inside of the square and attach the two legs to its edges with two rubber bands.



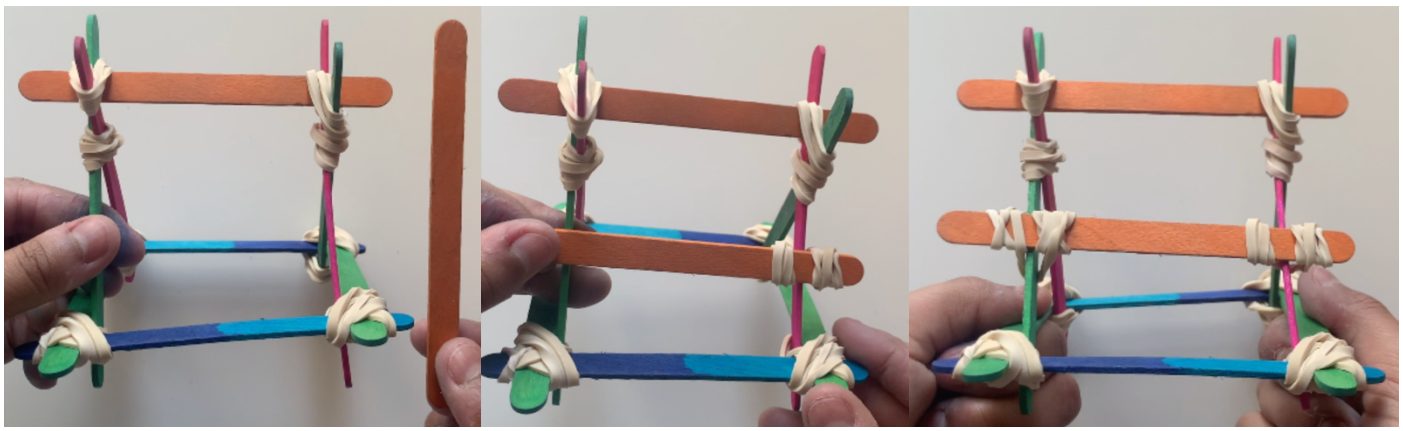
Step 6: Repeat Step 5 using the other crossed popsicle stick piece made earlier and attach it with two more rubber bands.



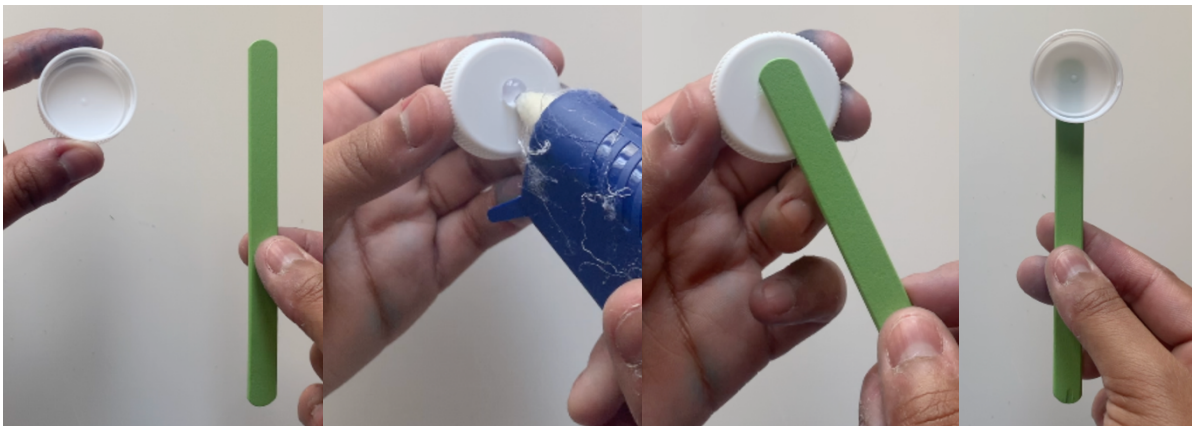
Step 7: Using another popsicle stick, place it horizontally across the two crossed pieces of popsicle sticks and attach them with one rubber band on each.



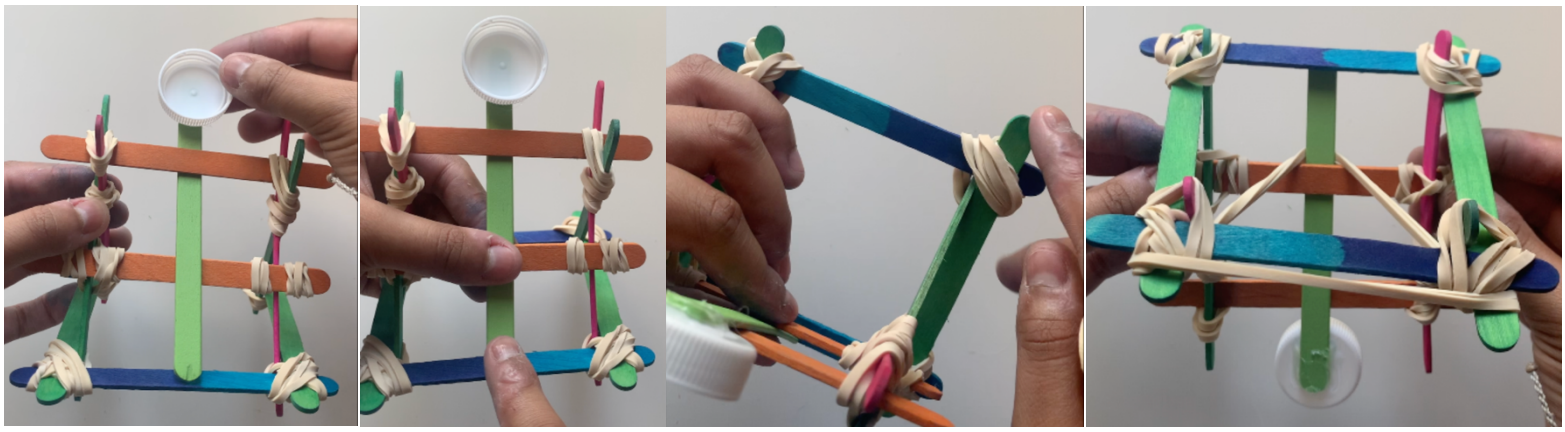
Step 8: With another popsicle stick, place it horizontally and flat against the entire structure, half the way down. Attach both sides with two rubber bands. To do this, tie it multiple times around the popsicle stick then loop it around the back of the structure and then again tie it multiple times around the popsicle stick. Repeat with the other side.



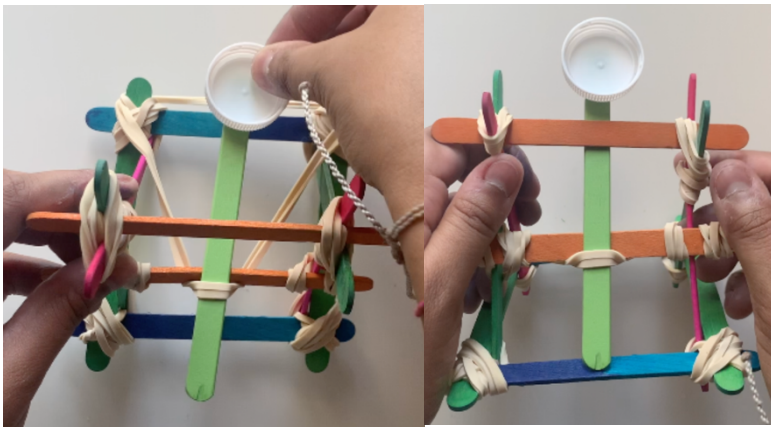
Step 9: Using the bottle cap attach it against the top of the popsicle stick with hot glue or tape.



Step 10: Take the stick with the bottle cap and thread it between the two sticks attached during steps 7 and 8. Make sure it placed behind the top stick and over the bottom stick to rest on top of the square base. Using another rubber band, thread it over the front of the stick and connect it to the back two ends of the square to form triangle. To increase the strength of the catapult, add another rubber band.



Step 11: Try it out! Place a small ball, marshmallow, or even a crumpled piece of paper inside of the bottle cap and release. If the catapult is working properly the lever arm should be able to be pulled back and released quickly.



Now that you have finished your catapult and tried it out, here are some questions to think about:

- Was your catapult successful in reaching your goal?
- What challenges did you face building it?
- If parts of it did not work correctly how did or how will you fix it?
- Even if it worked properly, how can you make it even better? Are there different materials or a different structure you could use?
- What did you learn or enjoy from making the catapult?

Conclusion

Hopefully, through this activity you have a better understanding of engineering and the design process. Apply these ideas to planning and building even more projects, whether it's a paper tower, a stick bridge, or an aluminum foil boat. Be creative and keep engineering!