

TAKE & MAKE KIT

Trebuchet

TIME: 20 minutes - 1 hour
ADULT SUPERVISION ADVISED

Follow instructional videos on Youtube
[@MilwaukeePublicLibrary](https://www.youtube.com/@MilwaukeePublicLibrary)



Milwaukee Public Library Makerspaces

What's in this kit?

Explore kinetic energy through designing your very own trebuchet using everyday items. Experiment with different counter weights and observe how they impact launch height and arch.

You will learn:

- Kinetic Energy
- Potential Energy
- Simple Mechanics

Let's Get Started!

Materials

4 popsicle sticks
1 paint stirrer
1 chopstick
1 piece of string
1 piece of a straw
1 piece of fabric
1 piece of tape
1 piece of wire

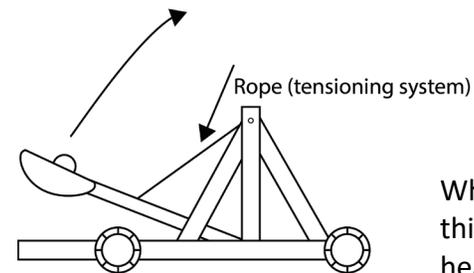
Tools

Glue
Scissors

Did You Know?

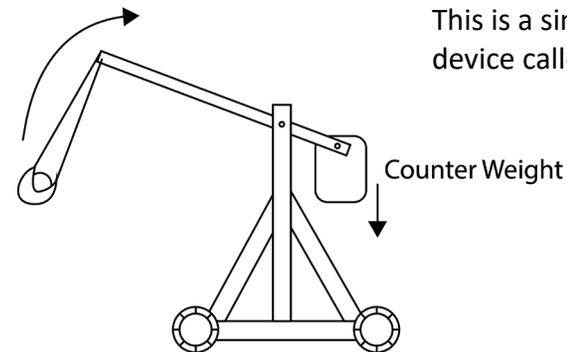
There's a difference between a trebuchet and a catapult.

When you think of a catapult, think of a slingshot that launches something with a rubber band. A catapult usually uses a launching system with a springy piece of wood and a tensioning system. This is usually a wound up piece of stretchy rope.



Catapult

When you think of a trebuchet, think of putting something heavy on one end of a seesaw. When you do that, the other side launches upwards. A trebuchet uses weight combined with the force of gravity to launch something. This is a simple mechanical device called counterweight.

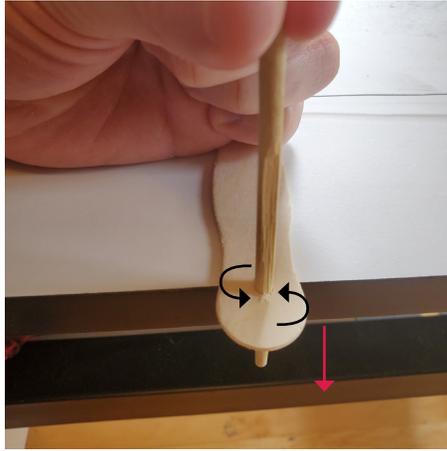


Trebuchet

Step 1 - Chopsticks into Popsicle Sticks

Wiggle the chopstick through the hole in the popsicle stick.
BE GENTLE. You don't want to break the popsicle stick.

TIP: Put the hole of your popsicle stick just off the edge of a table. This will make it easier to wiggle your chopstick back and forth through the hole.



Step 2 - Making an A-frame

Place a second popsicle stick on the same end of the chopstick.

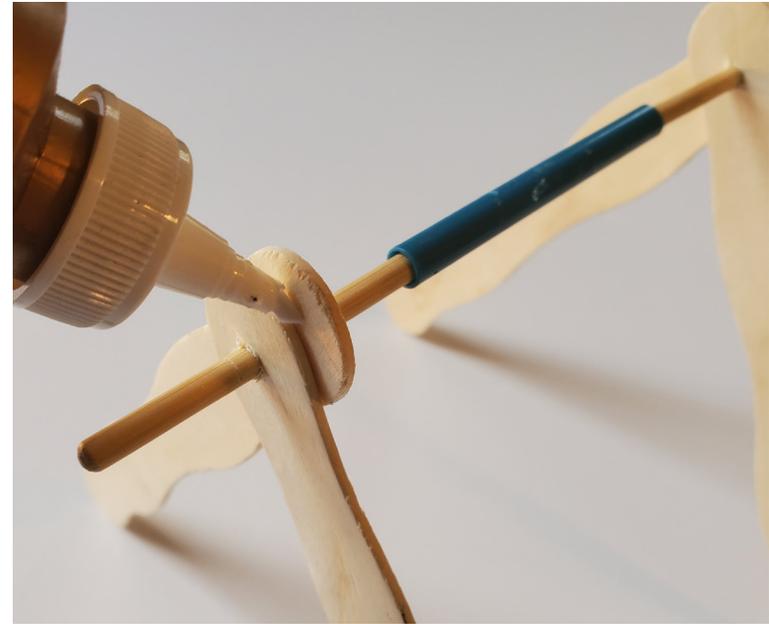
Step 3 - Straw to Pivot

Put the straw on the chopstick.



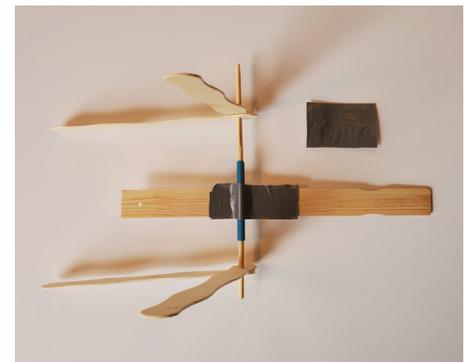
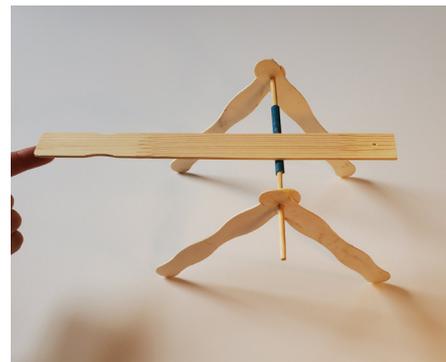
Step 4 - Complete the A-frame

Place the other two popsicle sticks on the other side of the chopstick.
Optional: Add glue to reinforce the popsicle.



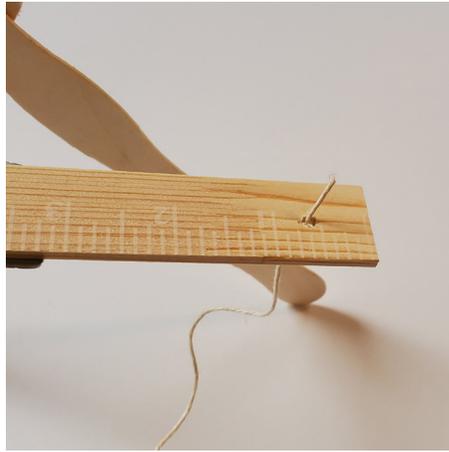
Step 5 - Installing the Arm

Tape the paint stirrer to the straw. The straw should be taped closer to the side with the hole. But you can experiment with this when the Trebuchet is completed. The straw functions as a pivot, and the paint stirrer swings like an arm. Use half the tape or less.



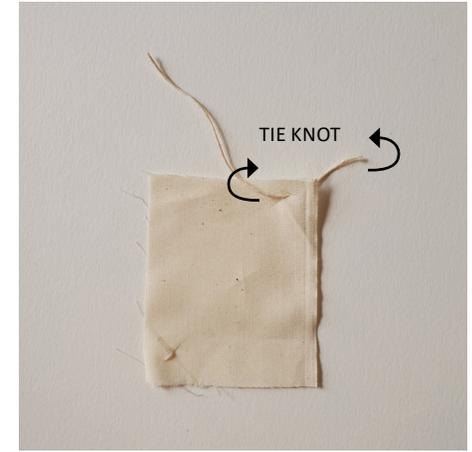
Step 6 - Attach String

Cut about 4 inches off of the long string, set it aside. (Will be used in Step 8). With the longer string, feed it through the hole in the paint stirrer. Make both ends even.



Step 8 - Making the Sling

Now cut two slits near opposite corners of the pieces of fabric. Use the shorter piece of string that you set aside in Step 6 and feed it through one of the holes in the fabric.



Step 7 - Connect the Trebuchet to the Counterweight

Now take the bag that this project came in and cut a small slit through the upper corner of the bag. Feed the string through the bag and tie a knot.

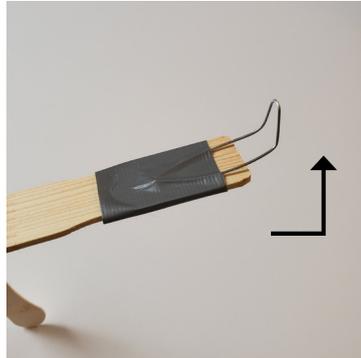
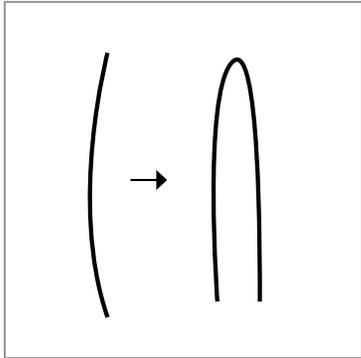


Tie a knot and leave a long end of the string. Repeat with other side of fabric. This bag will be the sling that you will use to launch your projectile.



Step 9 - Attach the Wire

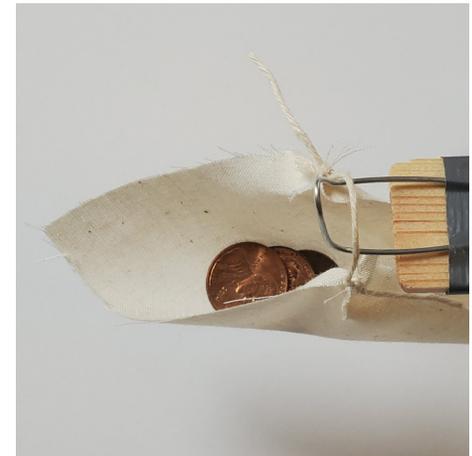
Take your piece of wire and bend it in half. Using the rest of the tape in the kit, tape the two ends of the wire to the side of the paint stirrer that does not have a hole. Bend the wire at an upward angle.



Step 10 - Make the counterweight, load your sling, and FIRE!

Place an object that weighs roughly 8 ounces in the plastic bag. Try something soft like a citrus fruit or a roll of duct tape. This plastic bag is your counterweight. Put something small into the sling you made in step 8. Try beans, coins, or pebbles.

Firmly hold onto the frame of the trebuchet with one hand while dropping the counterweight bag on the floor. Watch your projectile fly across the room!

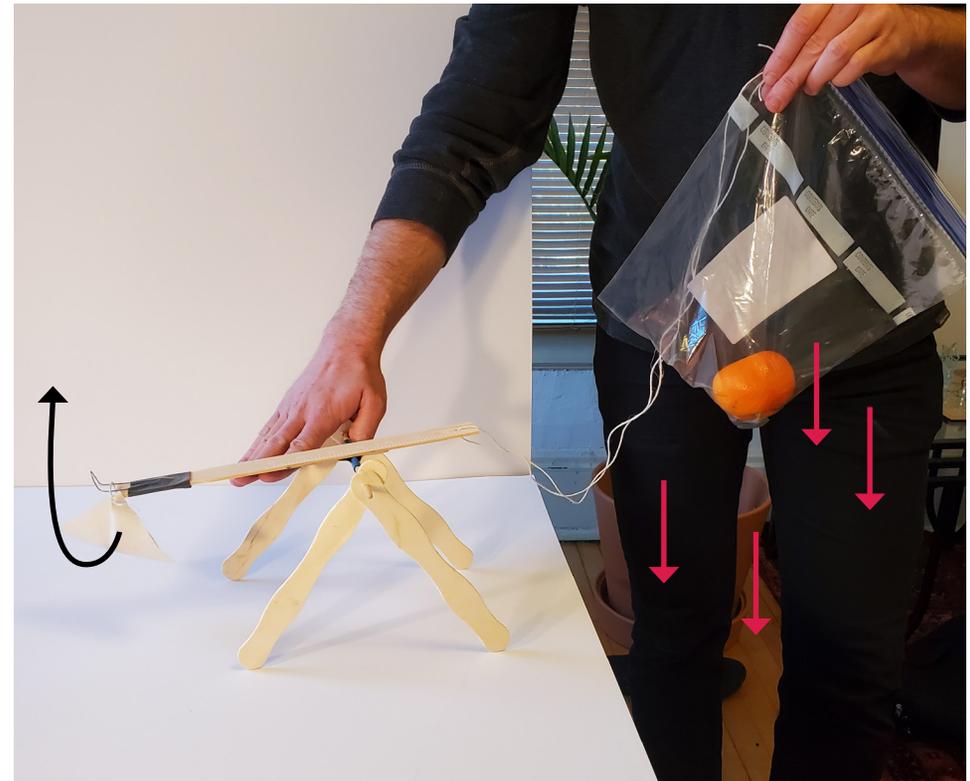


How does it work?

Potential energy: The energy an object has is based on its position. Think about a rock sitting on the top of a mountain. The rock's location gives it potential energy because if it were to fall, it would be gaining momentum. A rock positioned at the bottom of a mountain does not have the same potential energy because it has nowhere to fall.

Let's apply this idea to our trebuchet project. When you lift the bag with the counter weight, you're giving the trebuchet potential energy. When you drop the counterweight, you're converting the potential energy into kinetic energy.

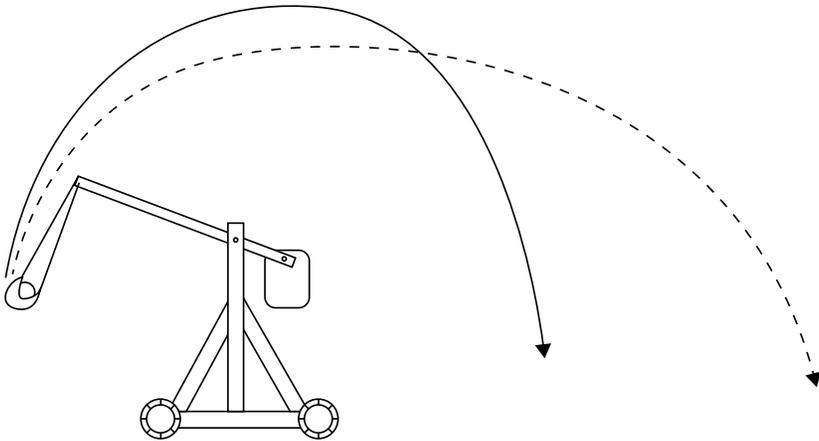
Kinetic Energy: Kinetic energy is the energy of movement. When you drop the counterweight bag and it hits the floor, the trebuchet launches a projectile. That flying projectile has kinetic energy.



Challenge

Experiment with fastening the paint stirrer in different positions.

How does the length of the paint stirrer, also known as the swinging beam, affect the arc of the projectile? The arc is the path in which the projectile flies through the air. Adjusting this will change the height and distance of the projectile.



Arc of the Projectile

What happens when you put something heavier in the counterweight bag?

Go Beyond

Make a target using household materials, how far away can you set up the trebuchet and still hit it? Can you move farther away if you launch a lighter object from your sling? What about a heavier object? What happens if you use a heavier or lighter object as your counterweight?

In medieval times (the years 400-1500), the trebuchet was used to attack and destroy castles by launching boulders and stones to break down their walls.

Build your own castle or fortress and break it down by launching objects at it using your trebuchet.

Can you take this trebuchet to the next level?

If you have a rubber band in the house, experiment with using it to increase the launching force of your trebuchet. Fasten the rubber band around the swinging arm or to the legs of the trebuchet to increase tension. How else can you give your trebuchet more launching power?

HANG OUT,
MESS
AROUND,
GEEK OUT.



MILWAUKEE
PUBLIC LIBRARY

We'd love to see what you come up with.
Please share and tag us with your creations
at [@MPLCreates](https://www.instagram.com/MPLCreates) on Instagram or email us
at MPLCreates@milwaukee.gov