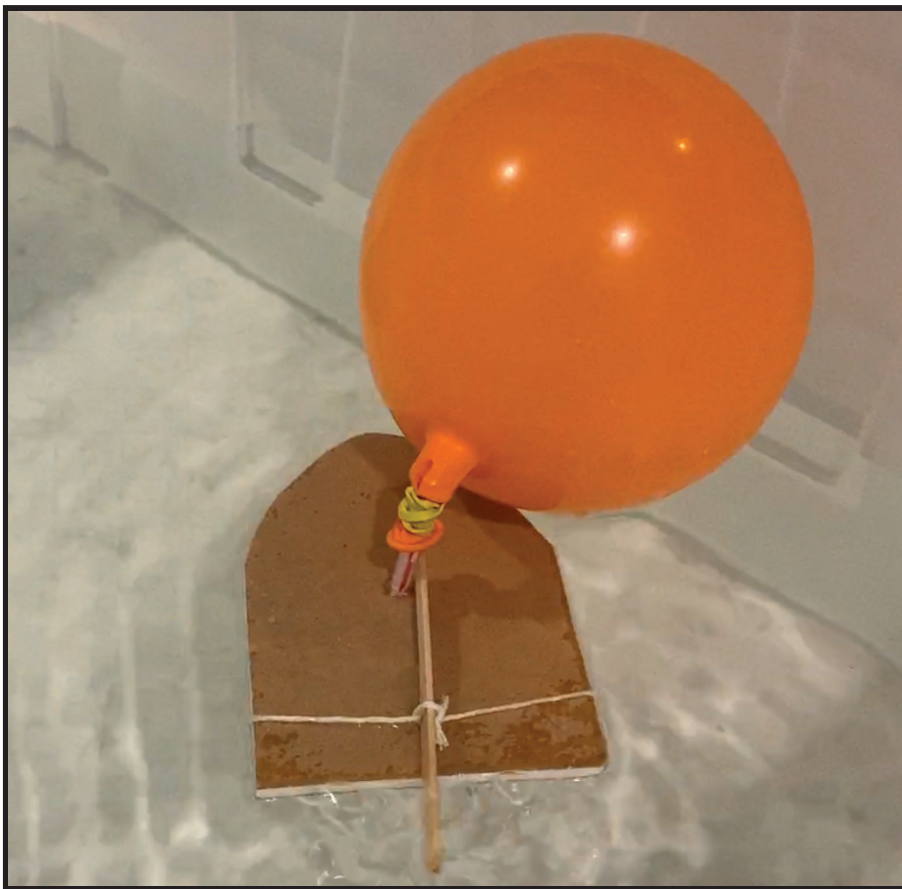


# **SHIFTING RHYTHMS**

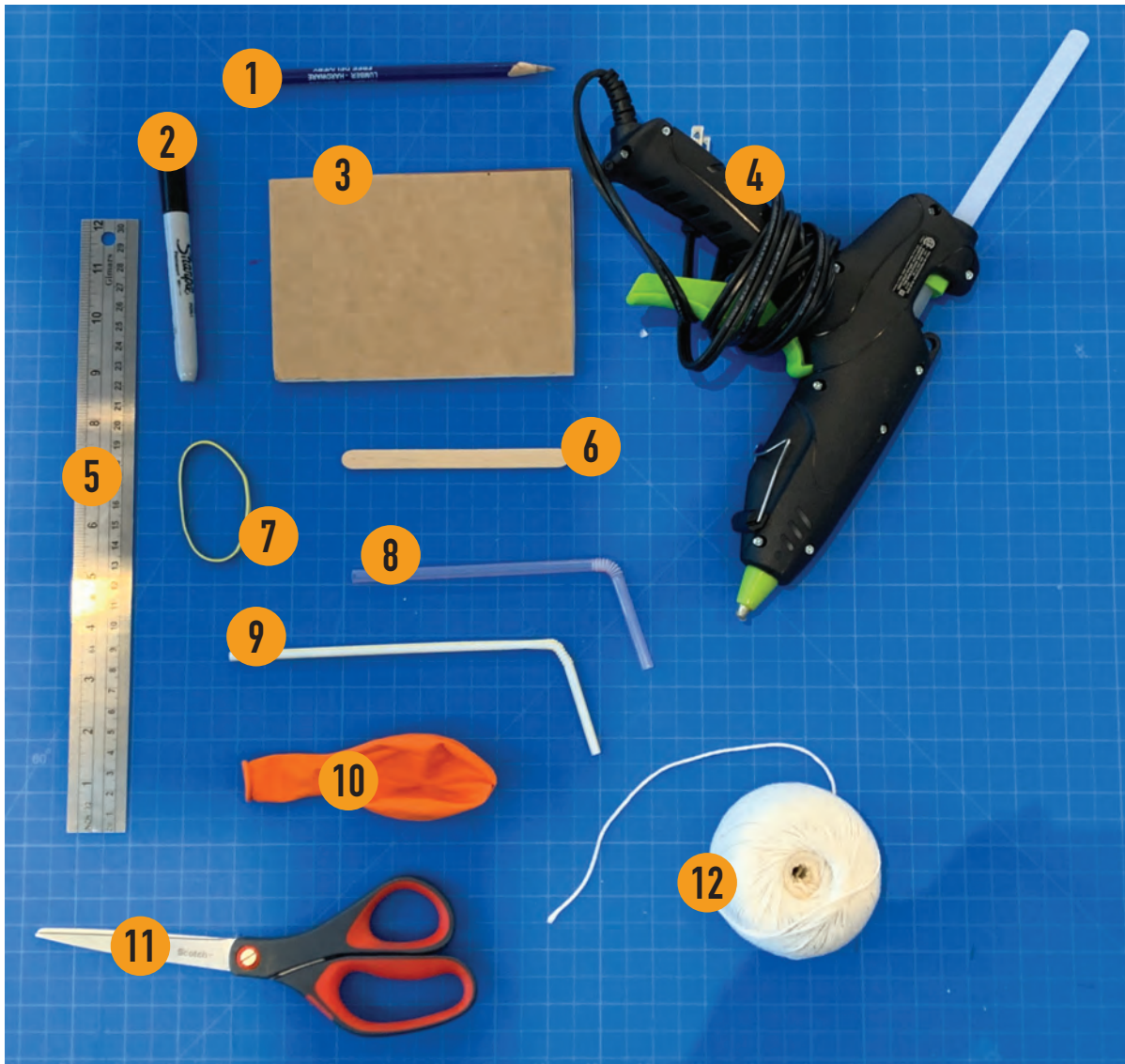
## **BOATS**

**Time Estimate: 2 hours**



**Tags: Design, Mechanical, Arts**

# Part 1: Materials and Tools



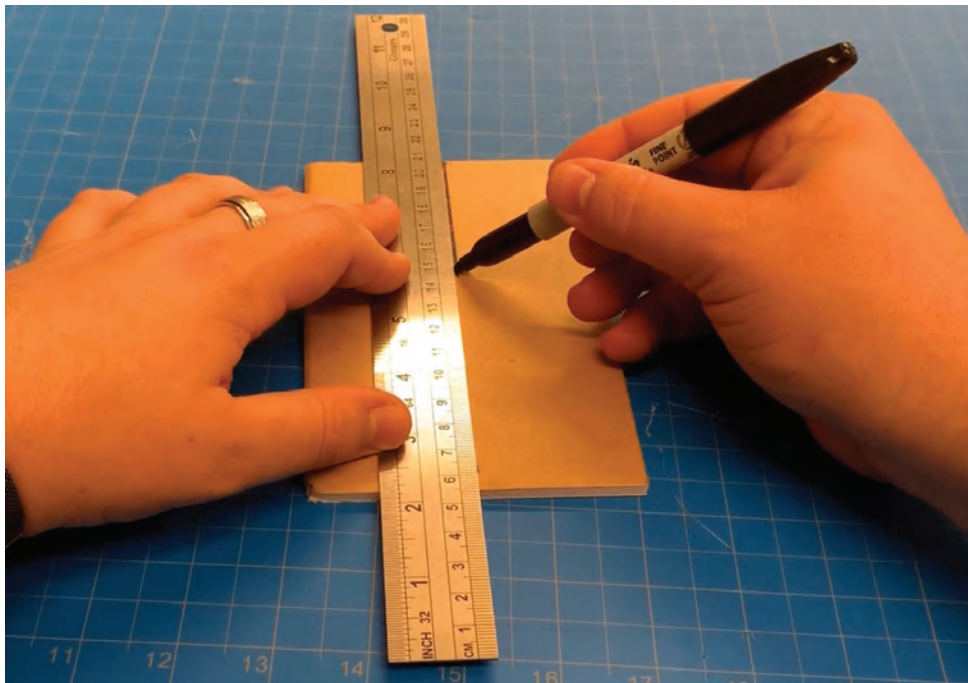
**To build your boat, you'll need:**

- |                            |                       |
|----------------------------|-----------------------|
| <b>1. Pencil</b>           | <b>7. Rubber Band</b> |
| <b>2. Marker</b>           | <b>8. Thick Straw</b> |
| <b>3. Foam Board Piece</b> | <b>9. Thin Straw</b>  |
| <b>4. Hot Glue Gun</b>     | <b>10. Balloon</b>    |
| <b>5. Ruler</b>            | <b>11. Scissors</b>   |
| <b>6. Popsicle Stick</b>   | <b>12. String</b>     |

## Part 2: Making the Hull



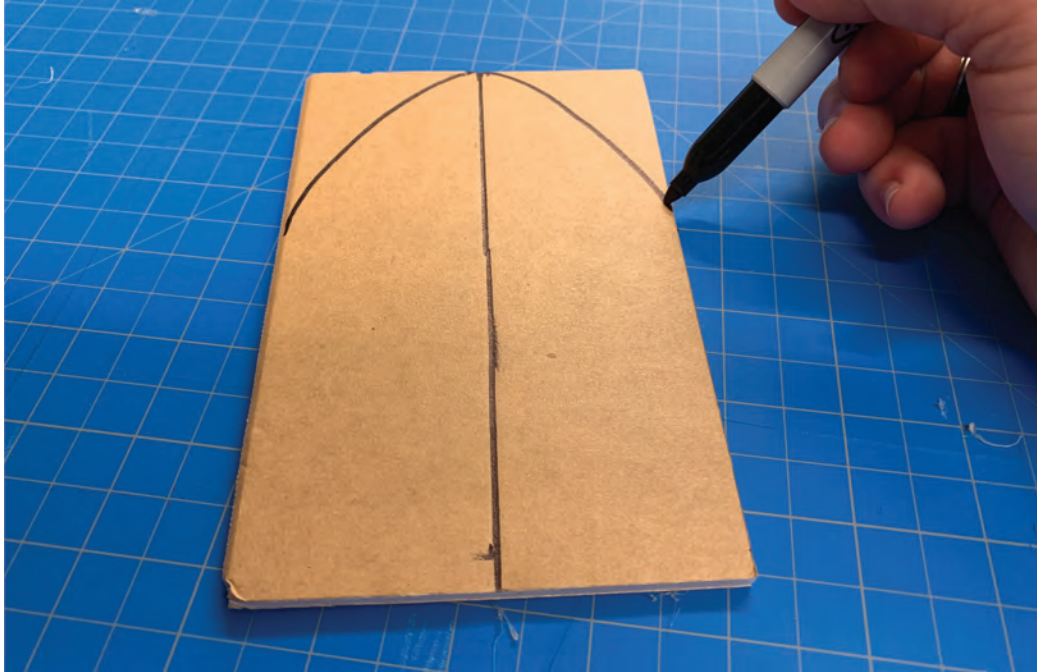
Use your ruler to measure how large your piece of foam board is. Write down these dimensions on the board with your marker.



Measure and mark the middle points of the short edges, and then use your ruler to draw a line to connect them.



## Part 2: Making the Hull



**Use your marker to draw some curves or lines on the board. Make the front point of the boat line up with the middle line you just drew.**

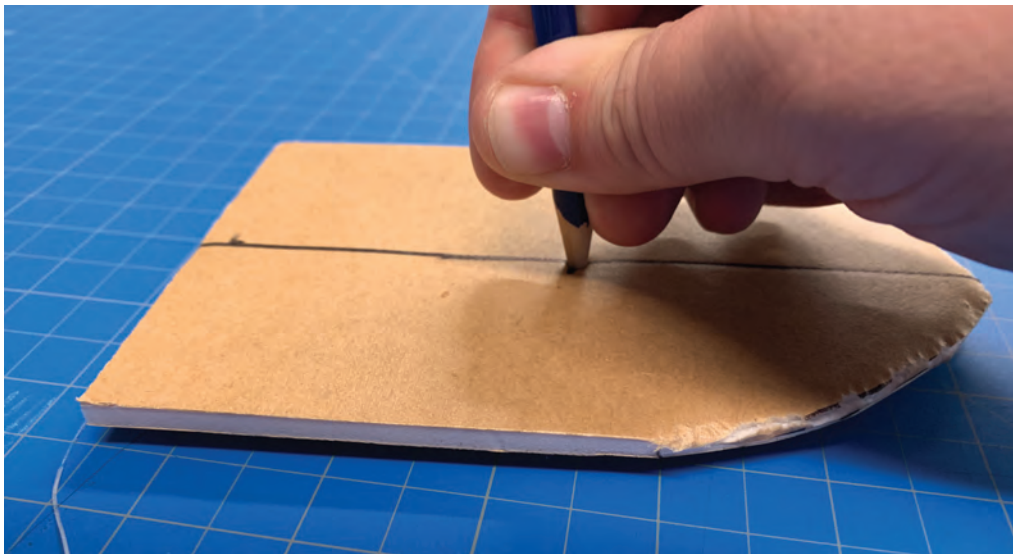


**Use scissors to cut along the curves that you just drew.**

## Part 2: Making the Hull

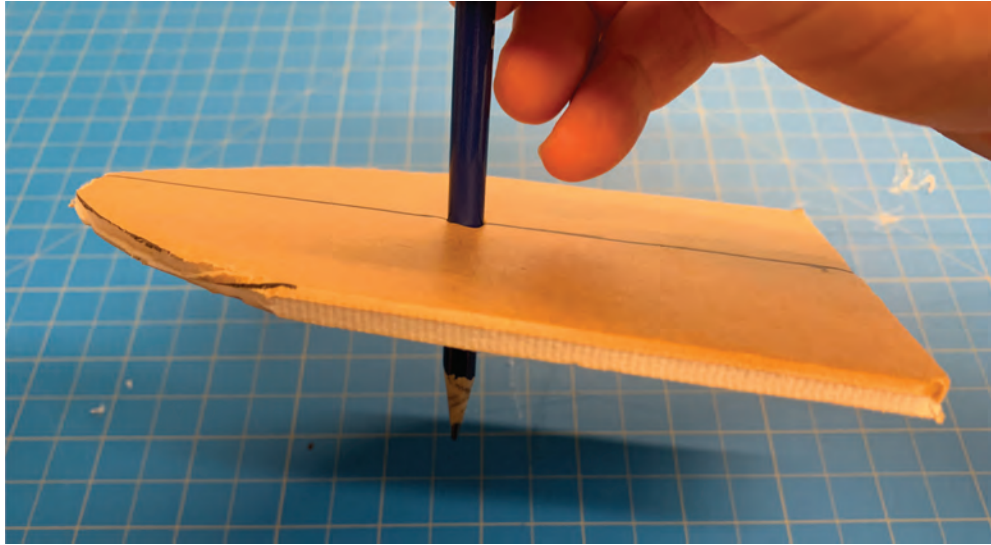


**Use the ruler to measure along the center line and make a mark that is 3 inches from the top point.**



**Place a piece of scrap foam, like one of the corners you cut off, underneath the boat, and use the pencil to poke a hole through the point you just marked.**

## Part 2: Making the Hull



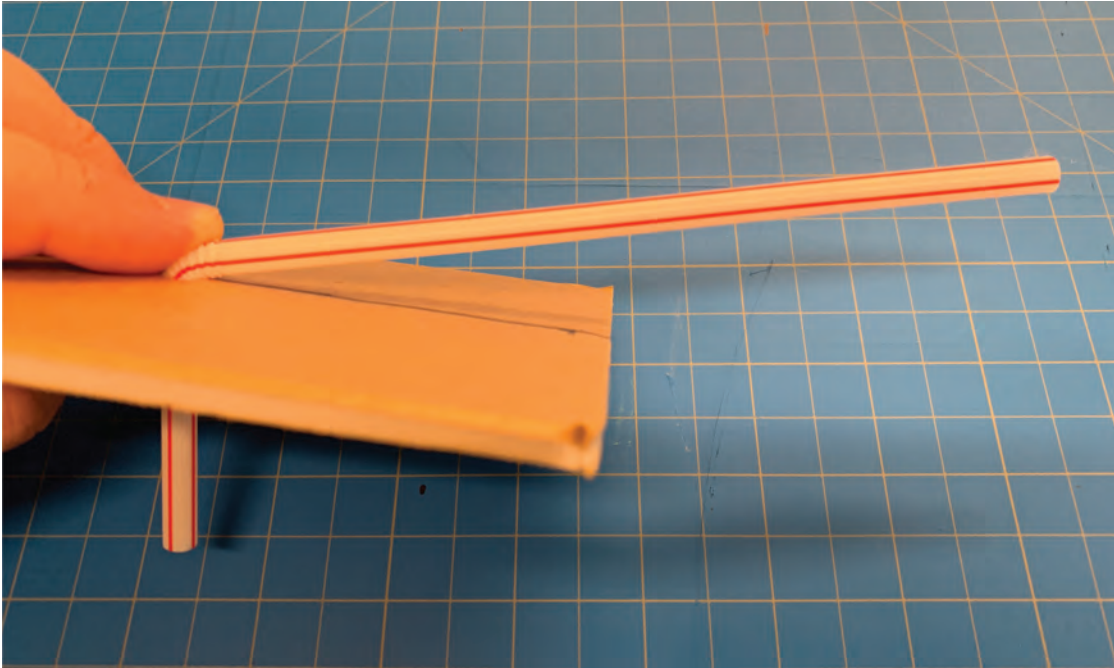
**Slide the pencil all the way through to widen the hole.**

**You now have the main shape of your boat. In the next steps, we'll add the straws to make the tailpipe and rudder.**

**If you want to decorate your boat with paint or markers, now is a good time.**



## Part 3: Adding the Tailpipe

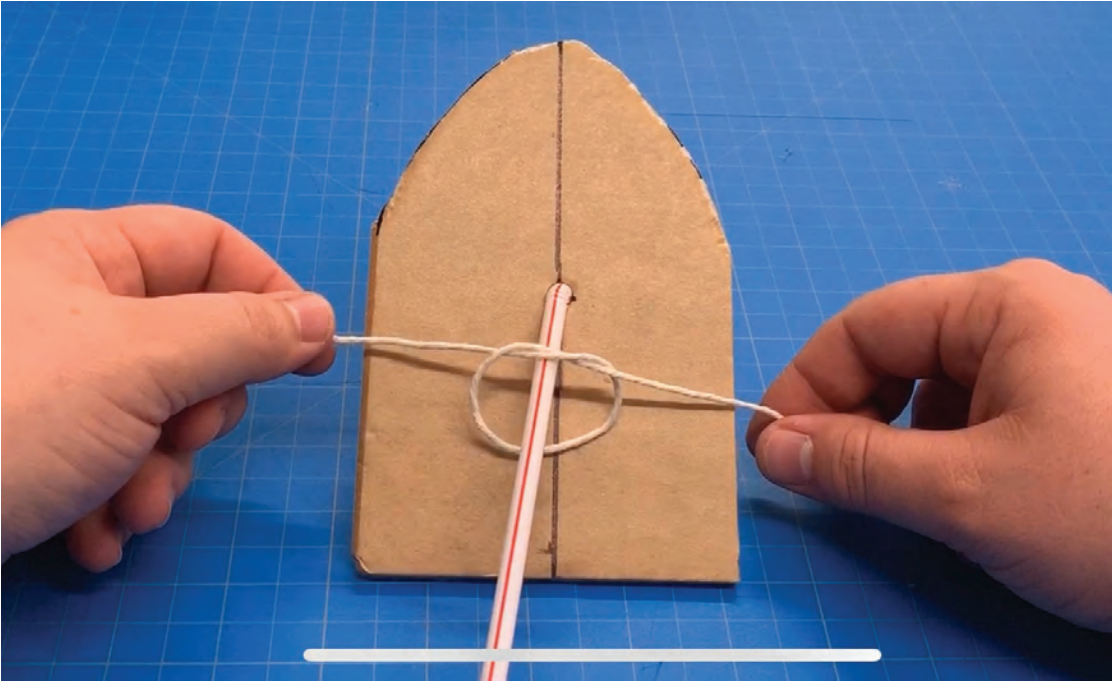


**Slide the thin straw through the hole you just made so that the short end pokes straight down through the hole.**

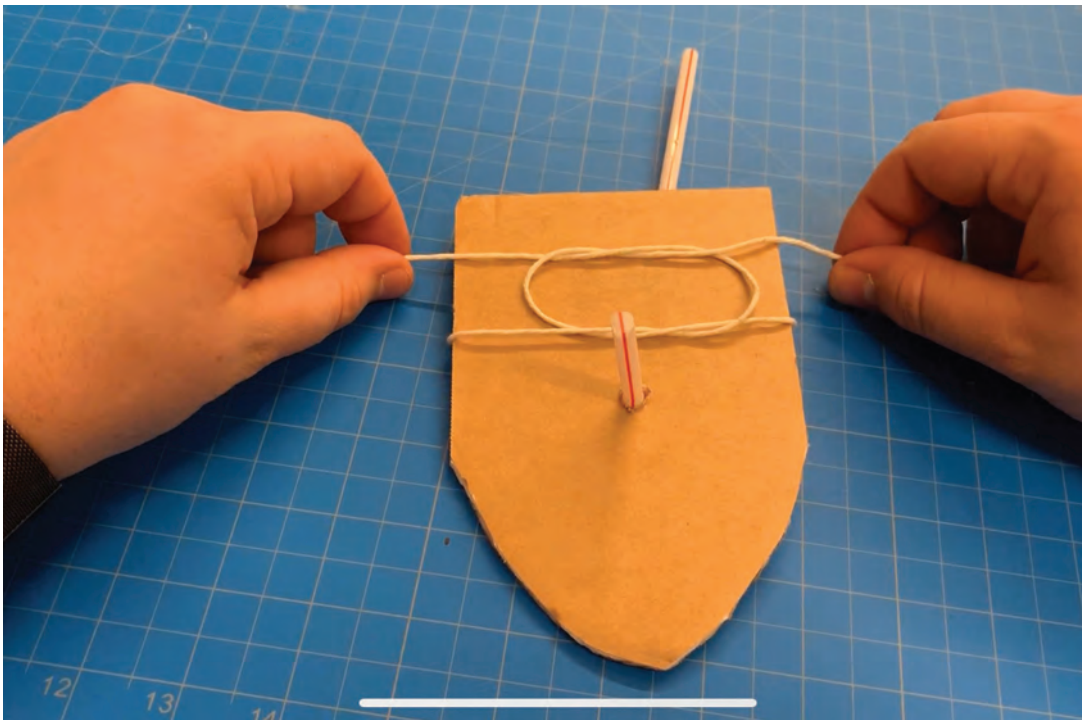


**Use scissors to cut a piece of string that is longer than 12 inches.**

## Part 3: Adding the Tailpipe



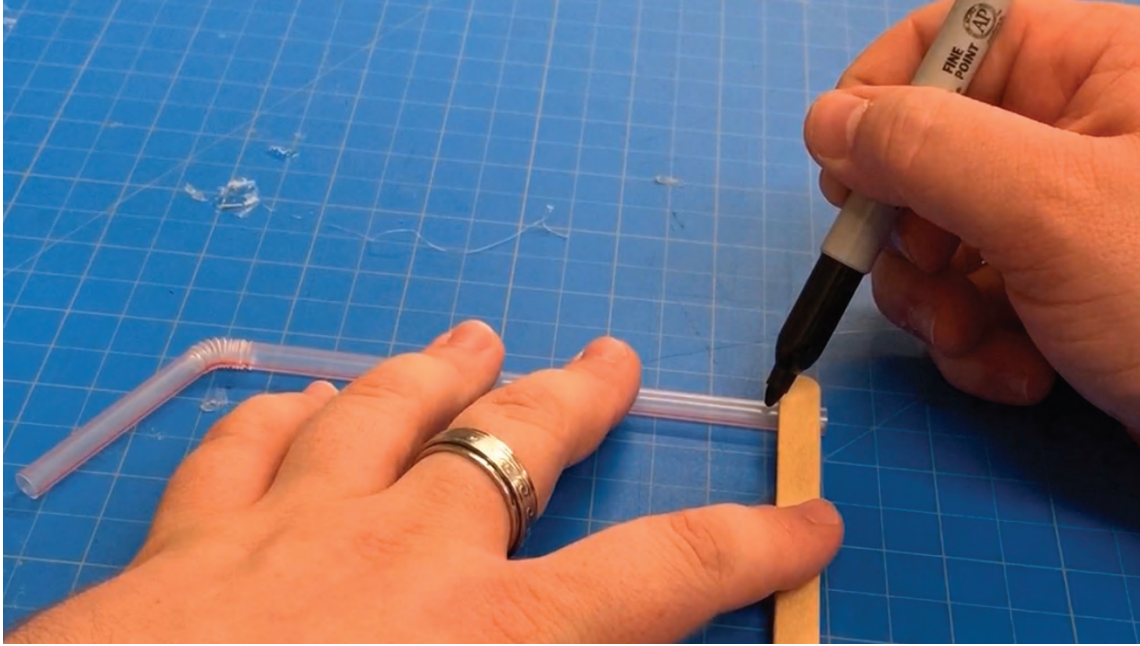
**Tie the string to the long end of the straw. Make a loop with the string around the straw, then pull one end of the string back through the loop to make a knot.**



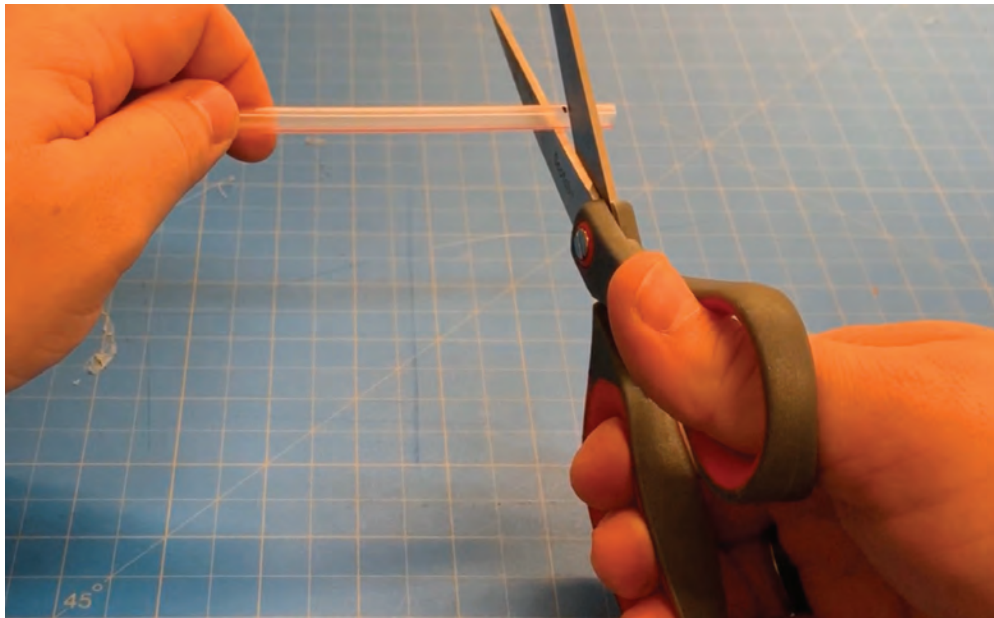
**Flip the boat over and tie the two ends of the strings together like this. Leave the loop in the string open for later!**



## Part 3: Adding the Tailpipe

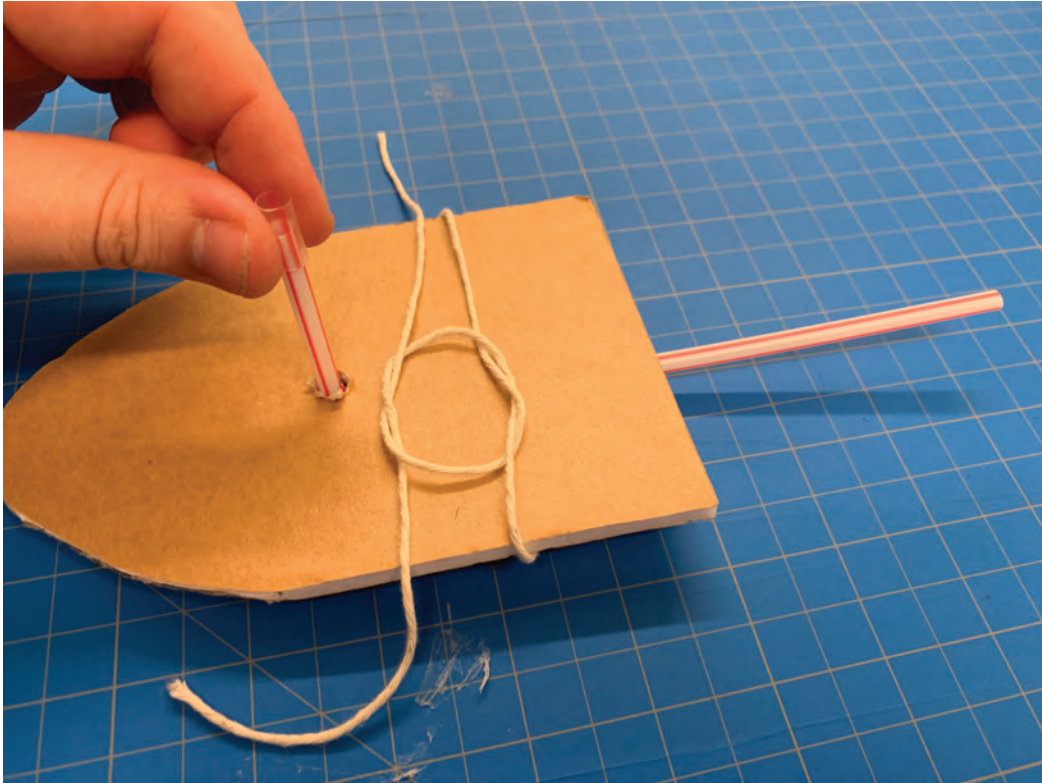


**Use the marker to draw a line on the wide straw that is a little bit wider than the popsicle stick.**



**Cut off this small piece of the straw where you marked.**

## Part 3: Adding the Tailpipe



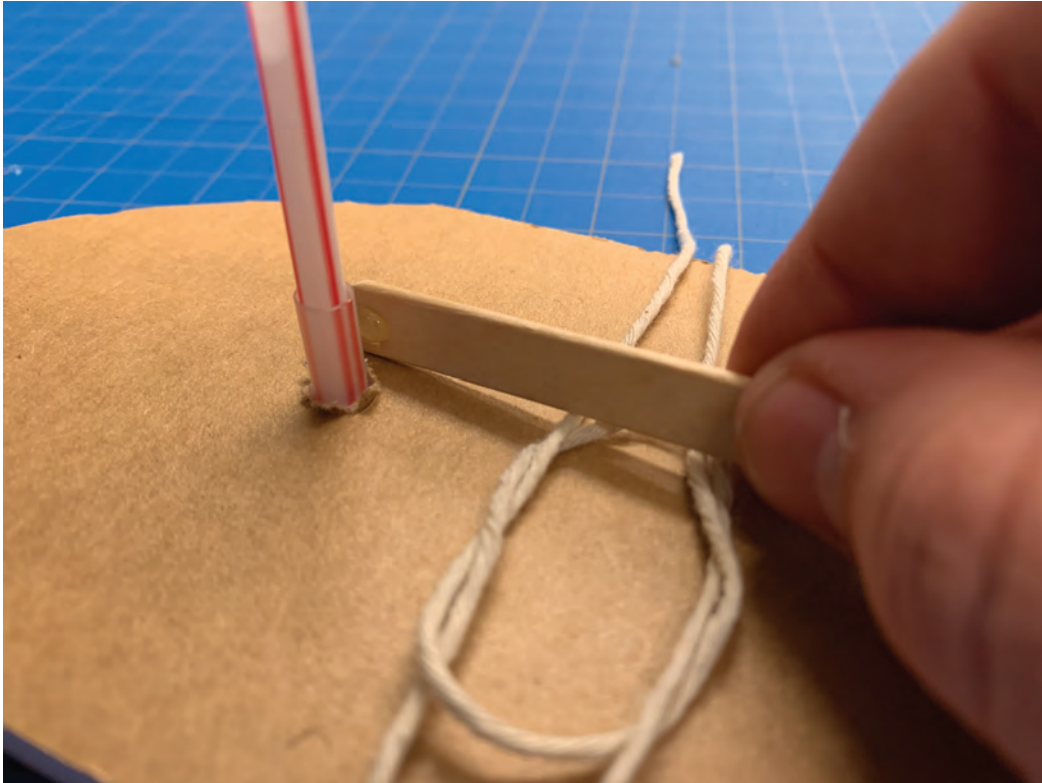
**Slide the piece of straw you just cut off around the straw on the boat.**



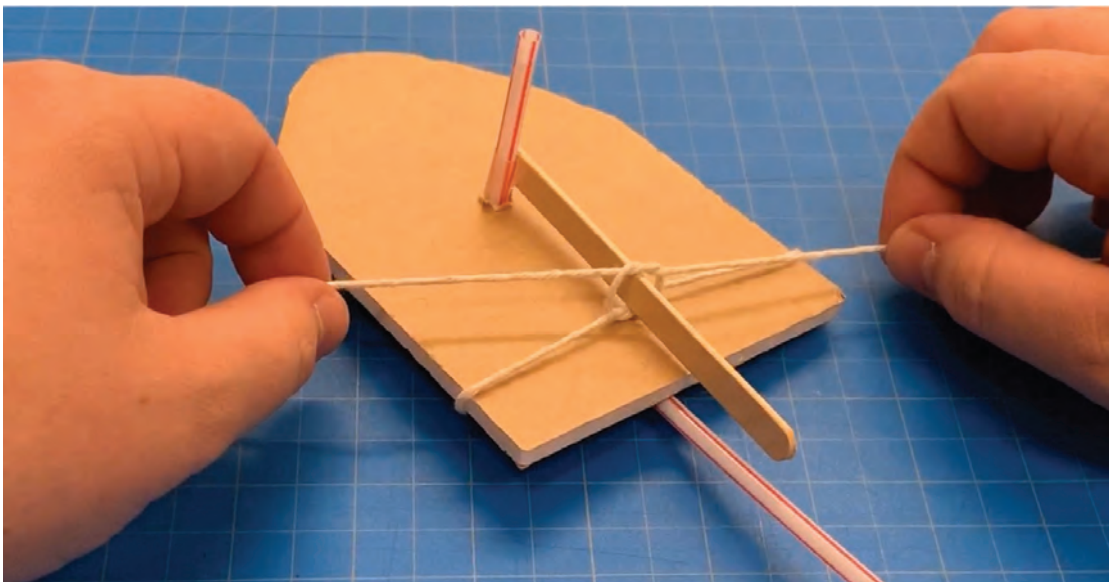
**Put a very small dot of hot glue onto the end of your popsicle stick.**



## Part 3: Adding the Tailpipe



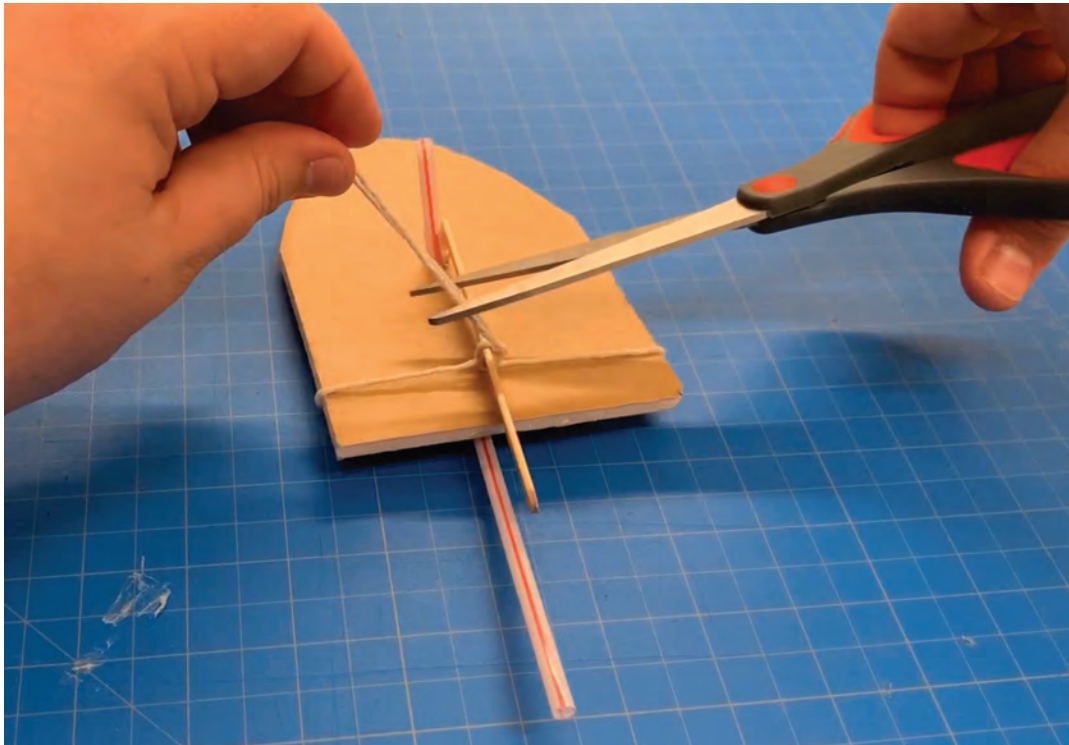
**Slide one end of the popsicle stick through the loop of string, and then stick the end with the hot glue onto the small straw piece.**



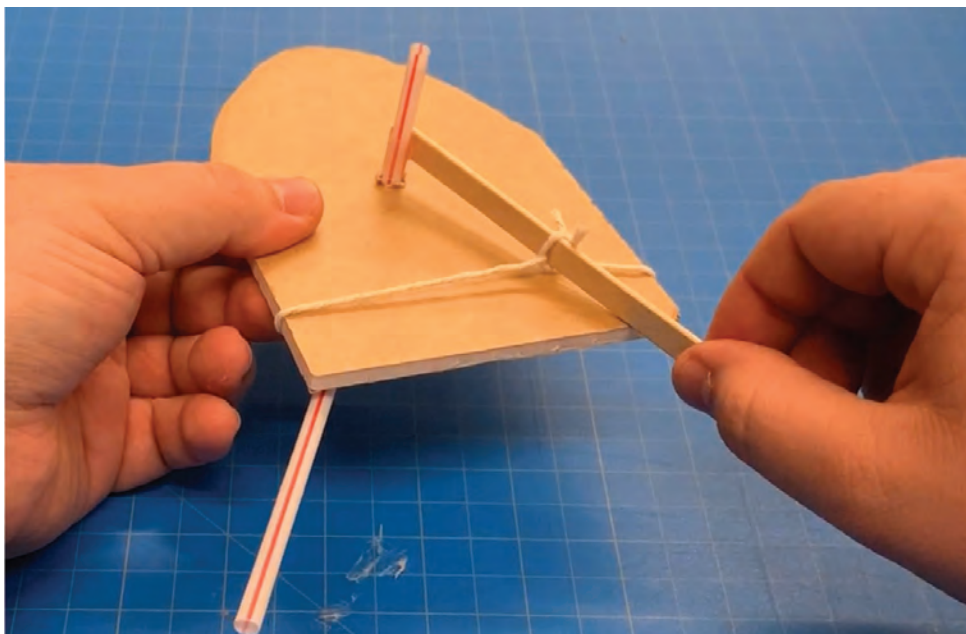
**Pull the string tight around the popsicle stick.**



## Part 3: Adding the Tailpipe

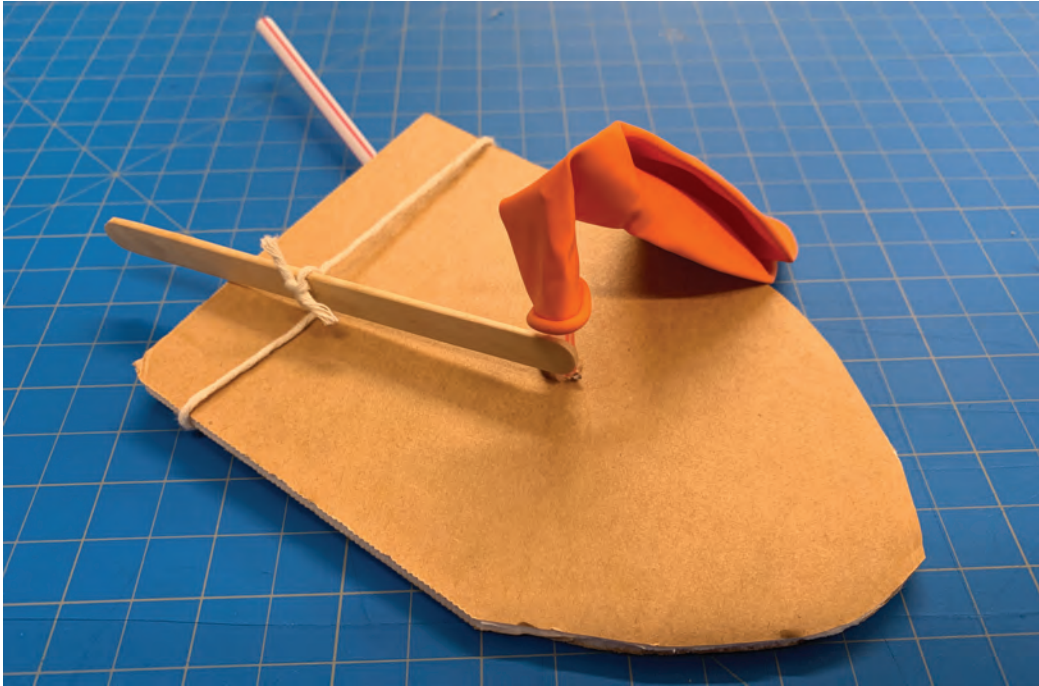


**Trim off the extra ends of the string.**

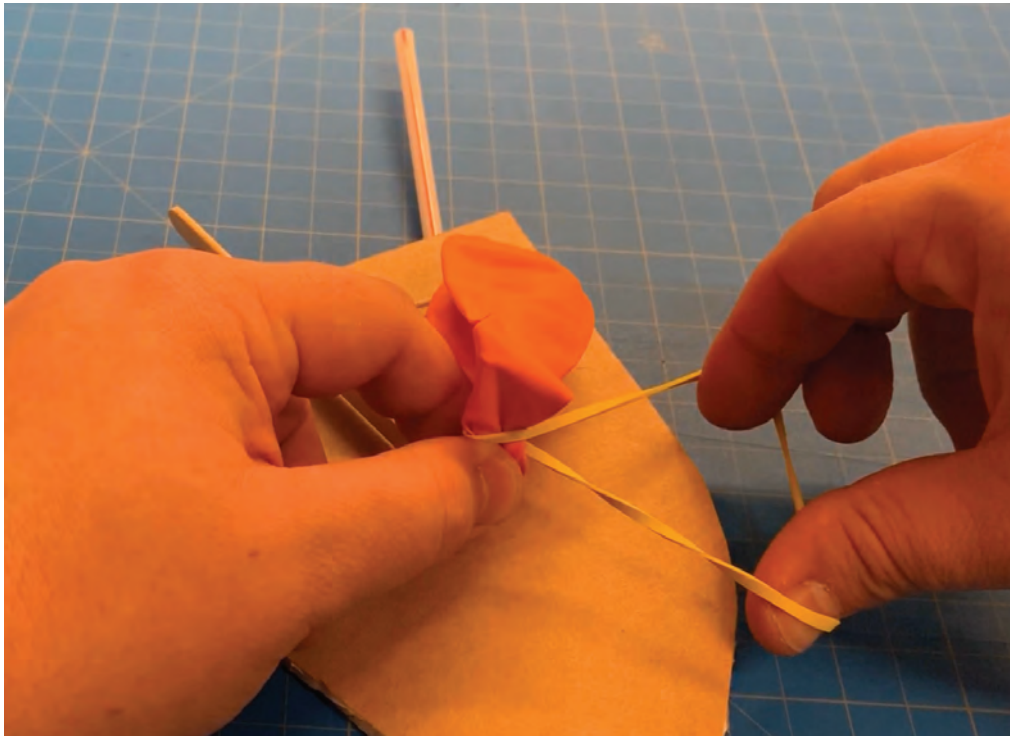


**If you turn the popsicle stick, the end of the straw should turn the other way.**

## Part 5: Adding the Balloon



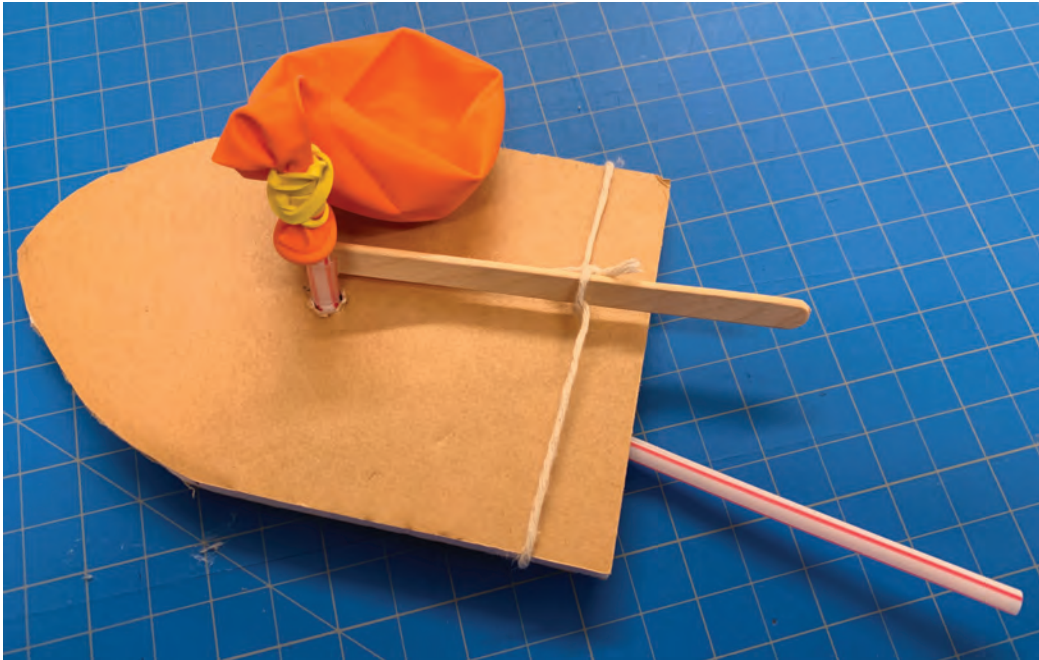
**Put the opening balloon over the straw.**



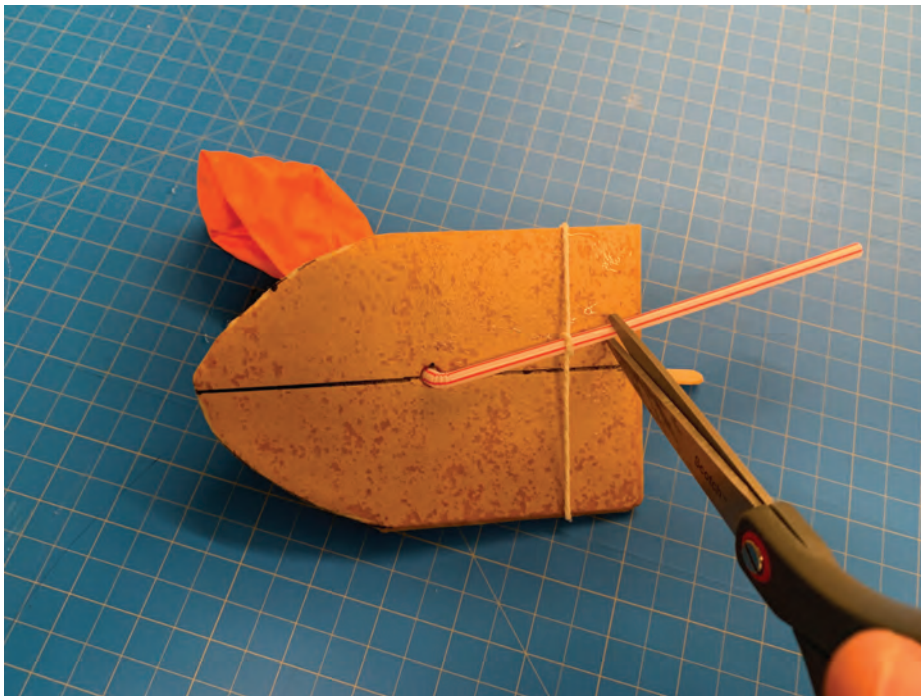
**Wrap the rubber band around the balloon to attach it firmly to the straw. You will need to wrap it around multiple times, sort of like tying a hair tie.**



## Part 5: Adding the Balloon



**When you finish attaching the balloon, your boat should look something like this.**



**Trim off the end of the end of the straw on the bottom of the boat (the long end of the straw). This will make sure that all the balloon's air gets let out underwater.**



## Part 5: Adding the Balloon

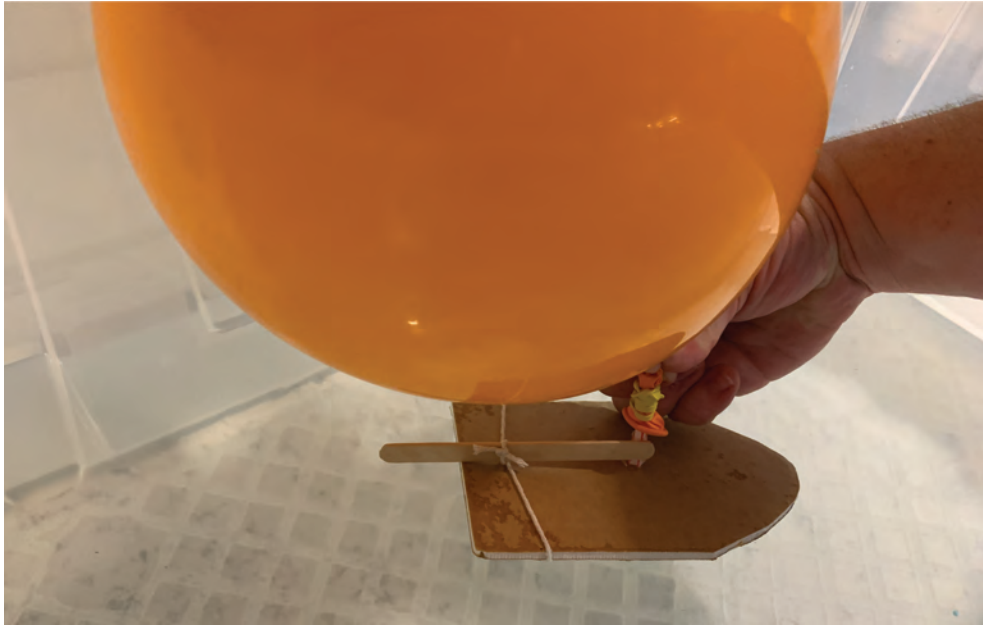


**Blow up the balloon through the straw. Can you feel the air coming back out of the straw?**

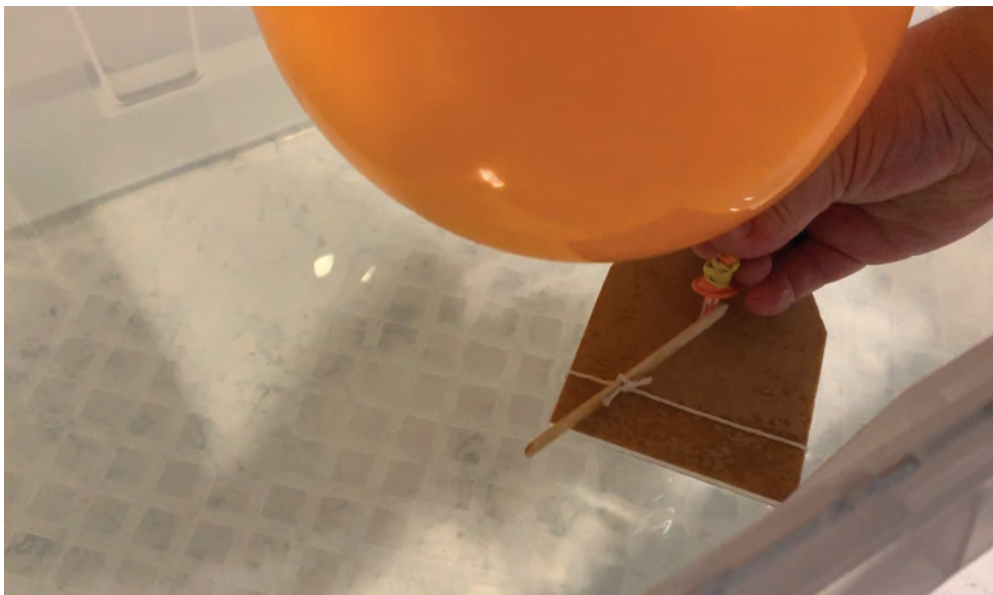
**Count how long it takes for all the air to come out of the balloon.**

**Your boat is done! Time to test it in the water.**

## Part 6: Testing Your Boat



**Blow up your balloon through the straw, and then pinch the end of the balloon so the air stays inside. Then, place your boat inside the pool, aim it in the right direction, and let it go!**



**Now try turning the direction of the popsicle stick to change which way the straw points. What does this change about how your boat moves?**

## **Part 7: How Does My Boat Work?**

**How does your boat move around in the water? Let's find out!**

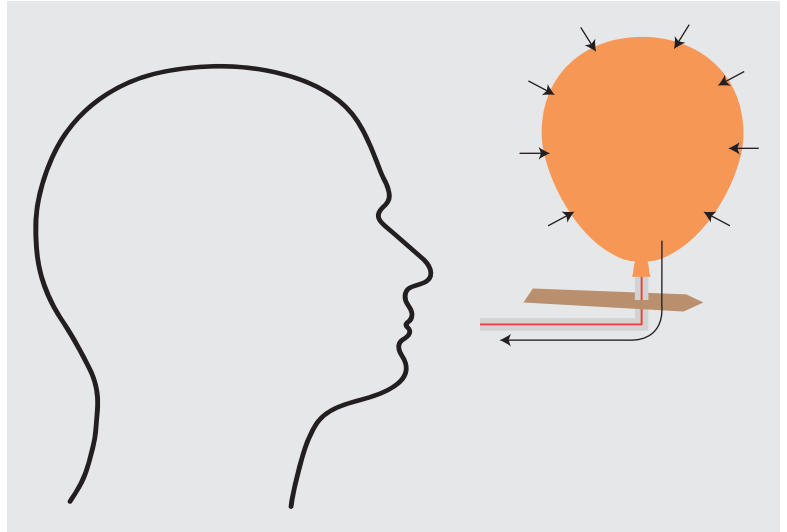
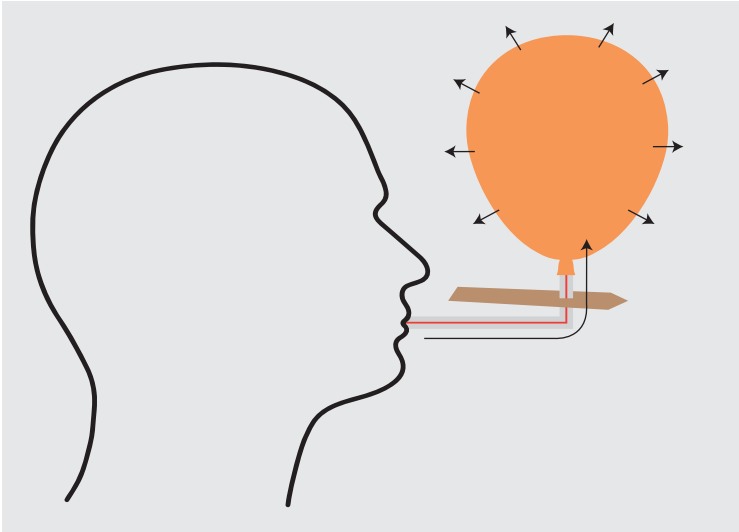
**What do you have to put into the boat to make it do something? How does it get from inside the boat to back outside of the boat?**

**How could you make your boat travel longer or farther in the water?**

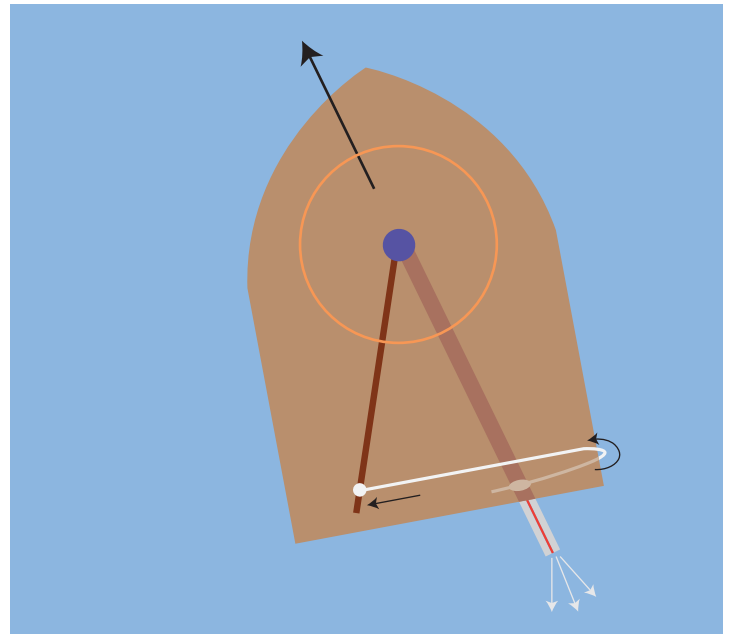
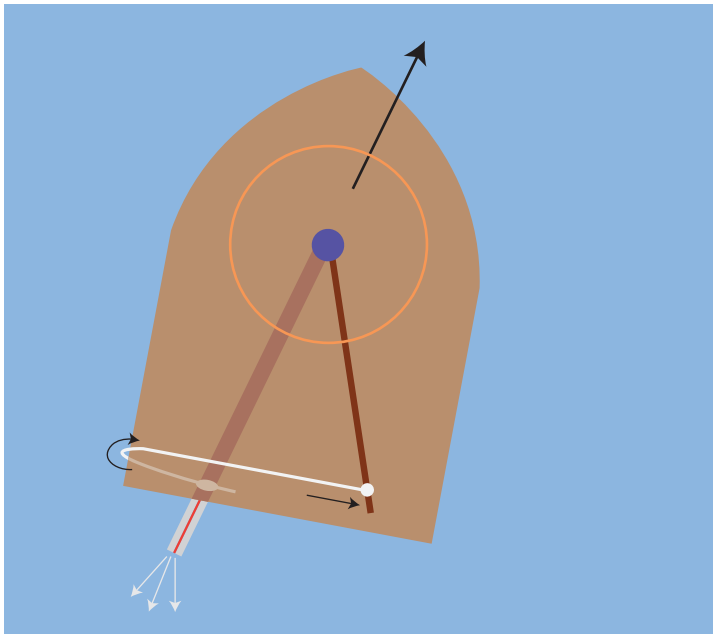
**Why does moving the popsicle stick make the boat go in a different direction?**



## Part 7: How Does My Boat Work?



When you blow in through the straw, you fill the balloon up with air. When you let go, the balloon squeezes the air back out. When the air comes out the end of the straw, it pushes the boat forwards through the water.



When you pull on the popsicle stick, the string tied onto it loops around to the bottom side and pulls the straw the other direction. This makes the air from the balloon come out at a different angle, which makes the boat turn. If you push the stick to the left, the boat will turn left. If you push the stick to the right, the boat will turn right.