

# Week 1: Balloon Car



# Welcome to the 2021 Summer STEM Program!

We are so excited to have you! A few rules:

- 1) We would really appreciate if you all had your cameras on! It really helps us guide you through the workshops!
- 2) Please ask any questions you may have during the process! These are challenging workshops with complex concepts so it is completely normal to run into problems or questions. Asking questions and fixing errors is all part of the experimental process!



# Isaac Newton

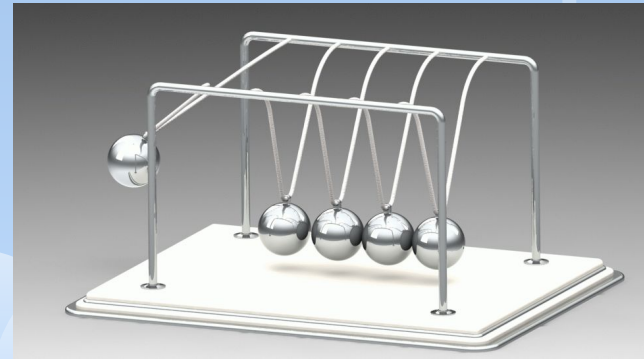
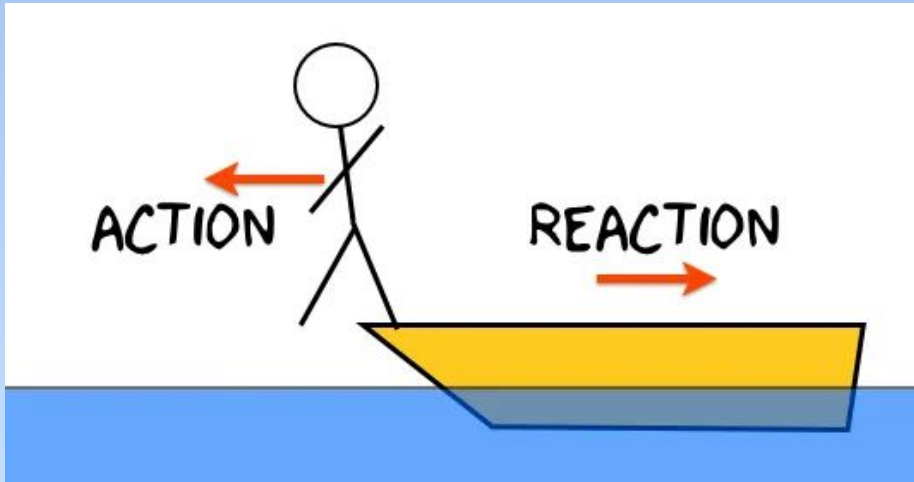


- 1643 - 1727
- English mathematician, physicist, astronomer, and theologian
- May have heard of the story of how he discovered the force of gravity when an apple fell on his head (2nd law of motion)



# Newton's 3rd Law

For every action (force) in nature, there is an equal and opposite reaction. In other words, if object A exerts a force on object B, then object B also exerts an equal and opposite force on object A.



Newton's Cradle

# Real World Applications:

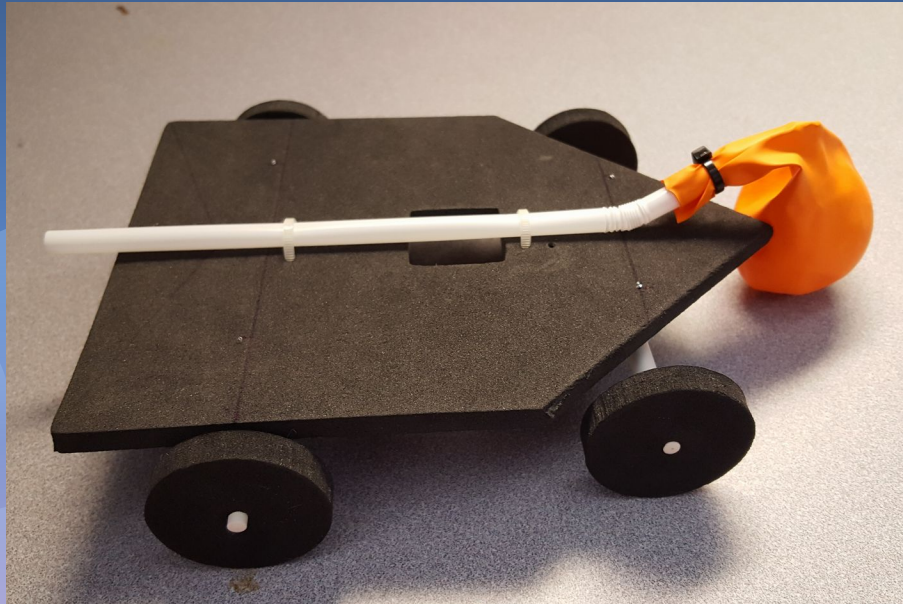
We see Newton's Third Law and the physics principles used in the Balloon Car in so many real world instances. For example: rockets!

All that burning fuel you see propels the rocket upwards because of Newton's Third Law: **every reaction has an equal and opposite reaction!**



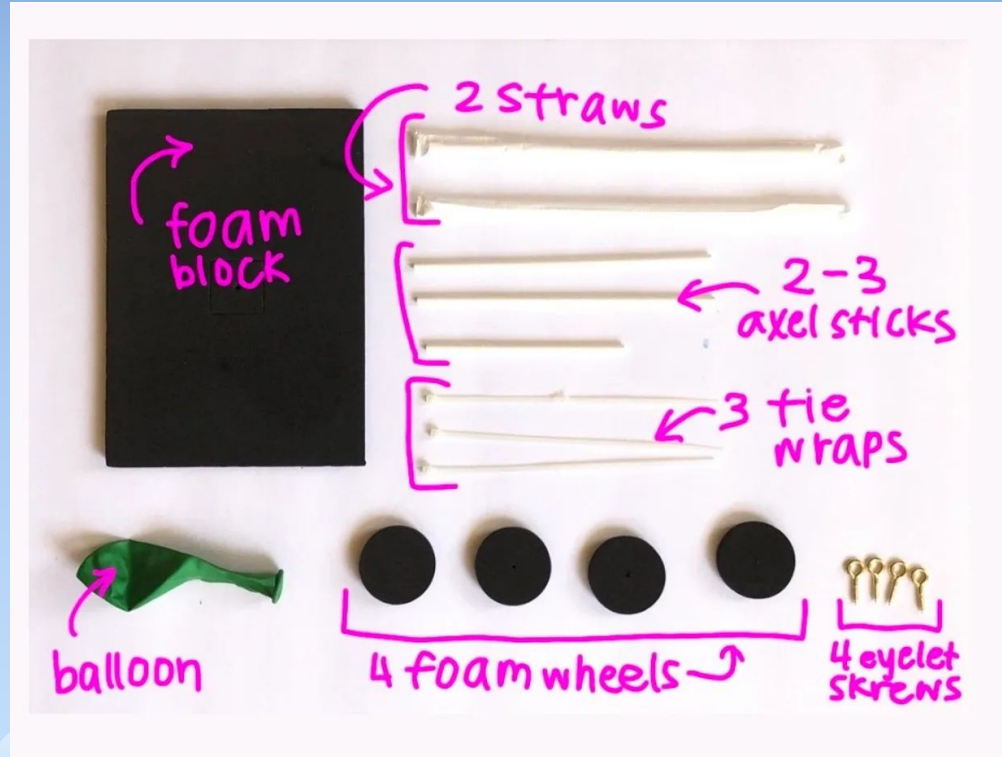
# Overview

You will be able to apply Newton's 3rd Law to the activity that we will be doing today.



What do you think the action and reaction will be with this balloon car? What are the forces involved in moving the car forward?

# What you need:



# Send us a video of your Balloon Car!

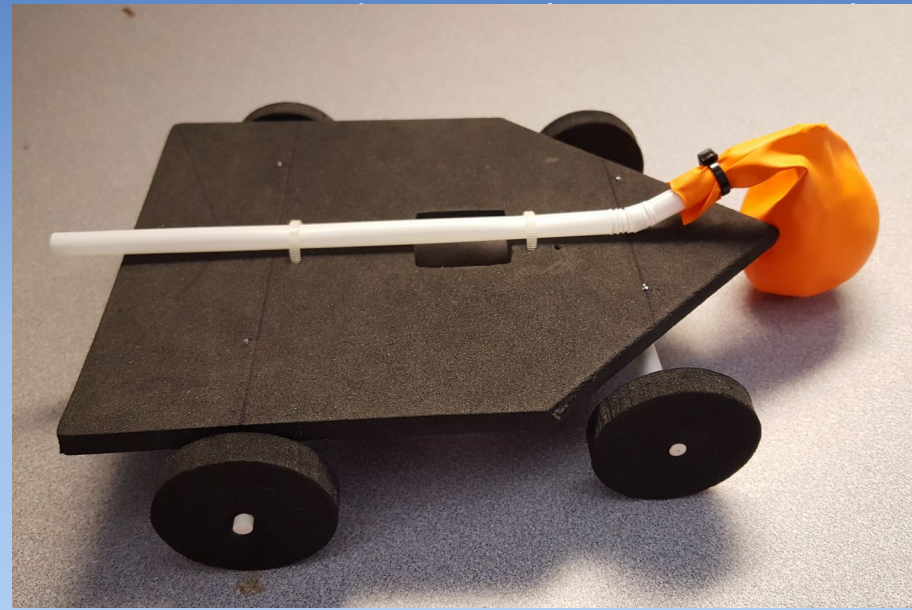
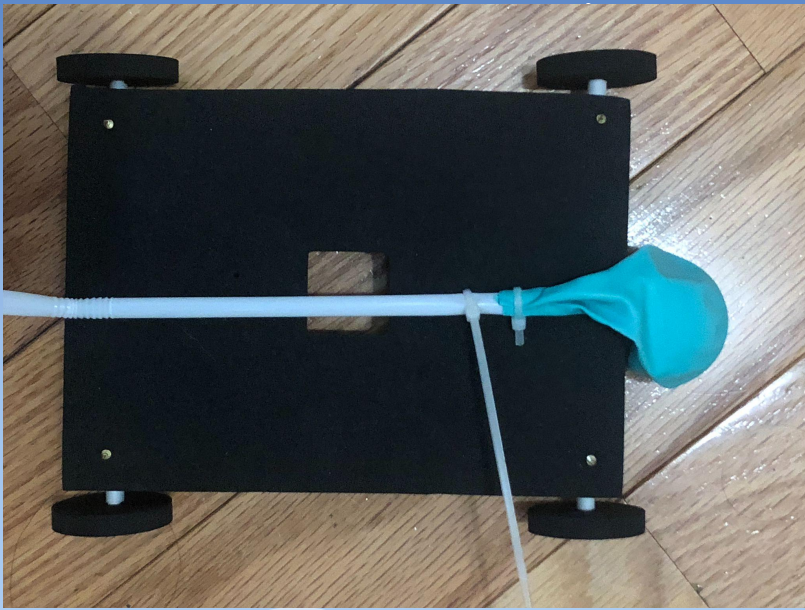
We really want to see all your cool designs so we will be holding a fun little Balloon Car Competition with two prizes:

- 1) Fastest/Farthest traveling car
- 2) Most creative/unique design

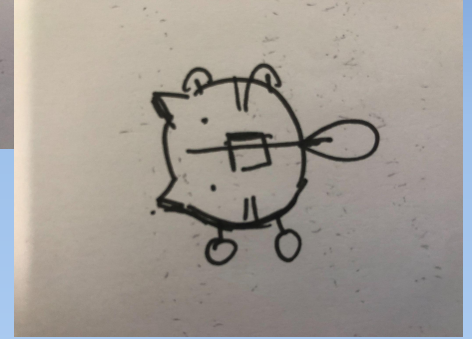
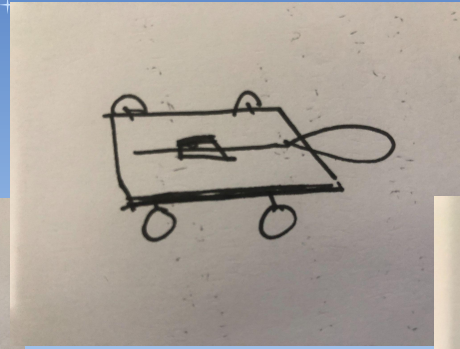
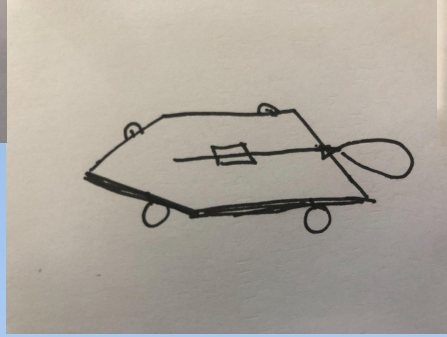
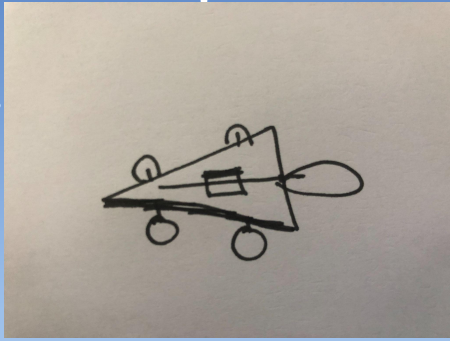
Please ask your parent to send us a video of your balloon car to our email address: [togetheraboveallofficial@gmail.com](mailto:togetheraboveallofficial@gmail.com) for the chance to win a small prize of a gift card!



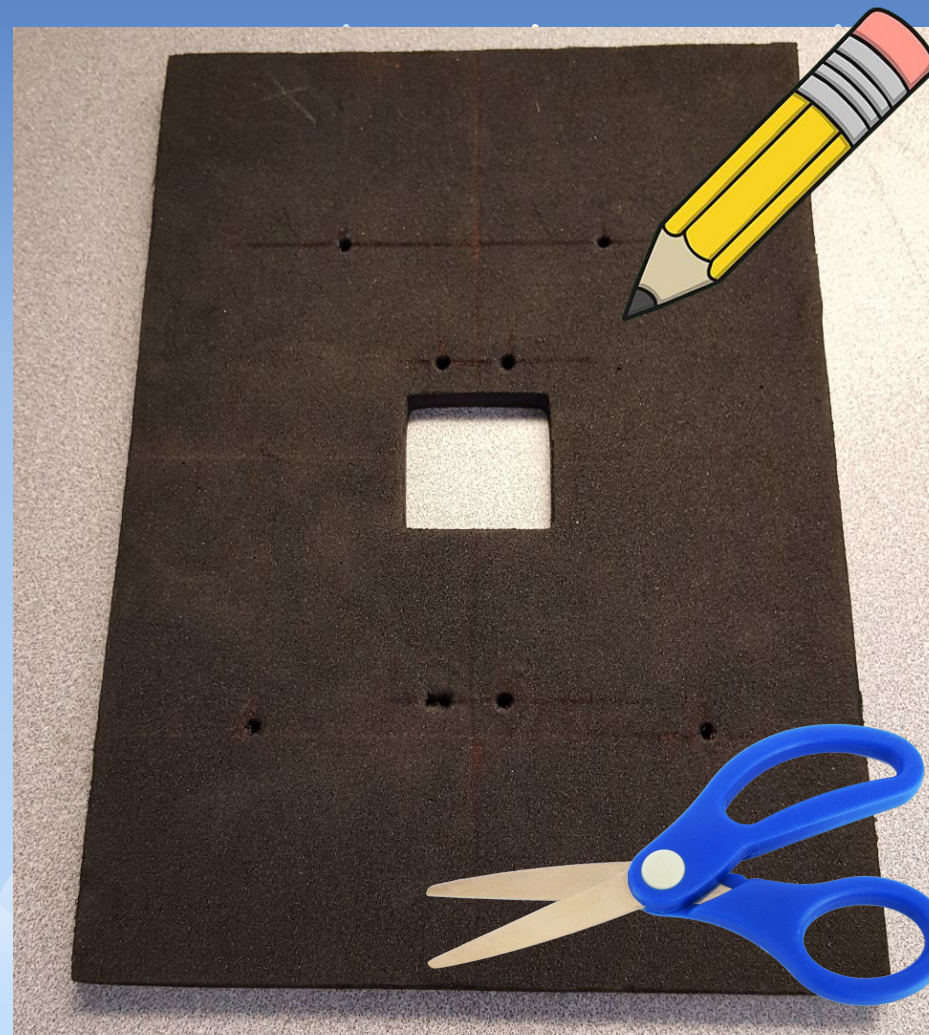
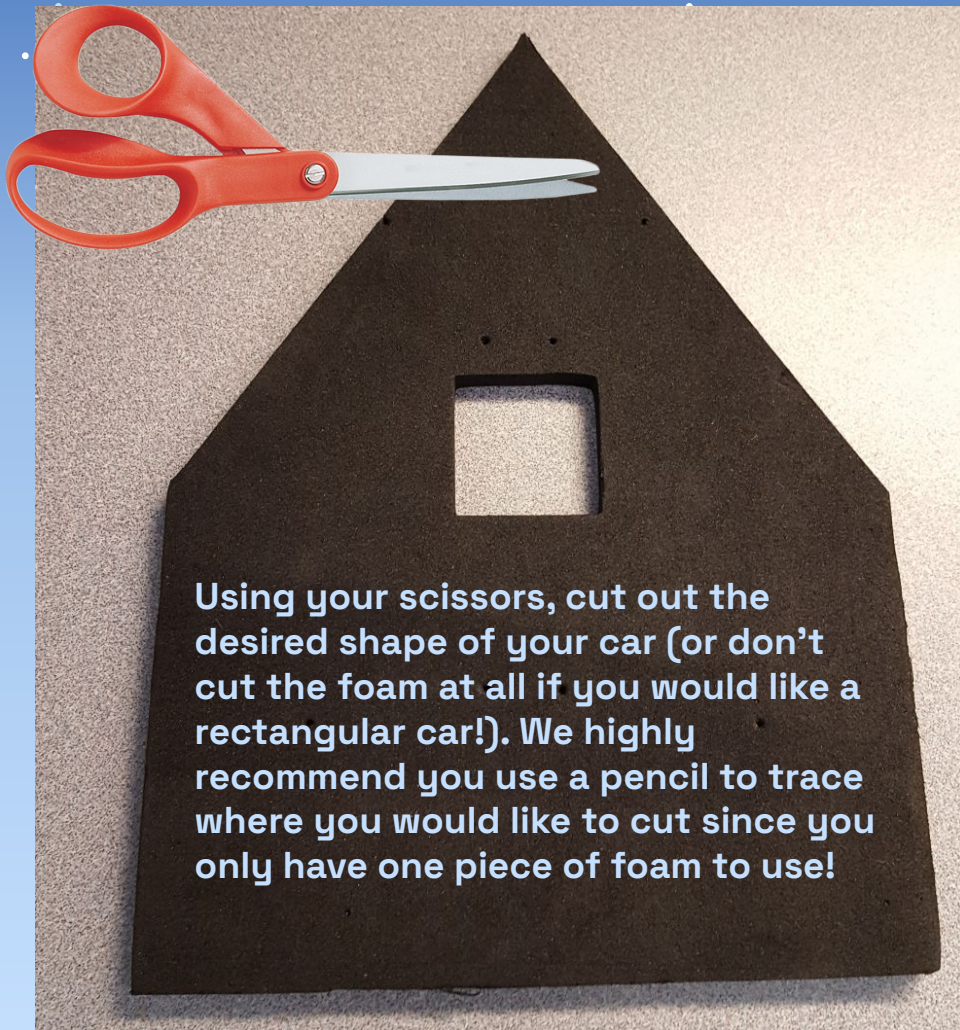
**Note: You have complete freedom over what your balloon car looks like! How does changing the shape of your car or the location the wheels are placed change how fast and how far the car can go? That's up to you!**



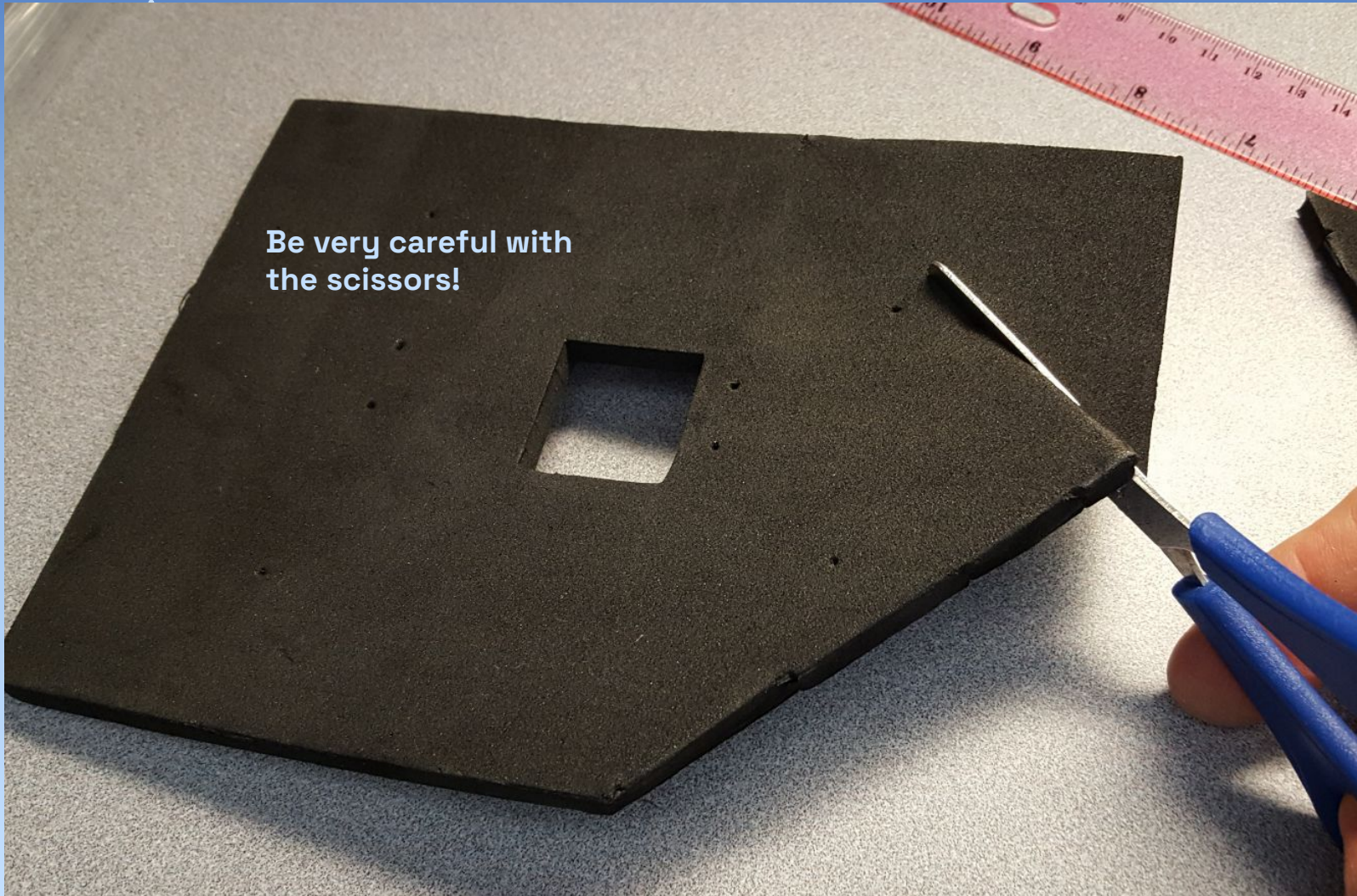
How would a Balloon Car that looks like the first photo compare to the one in the second?

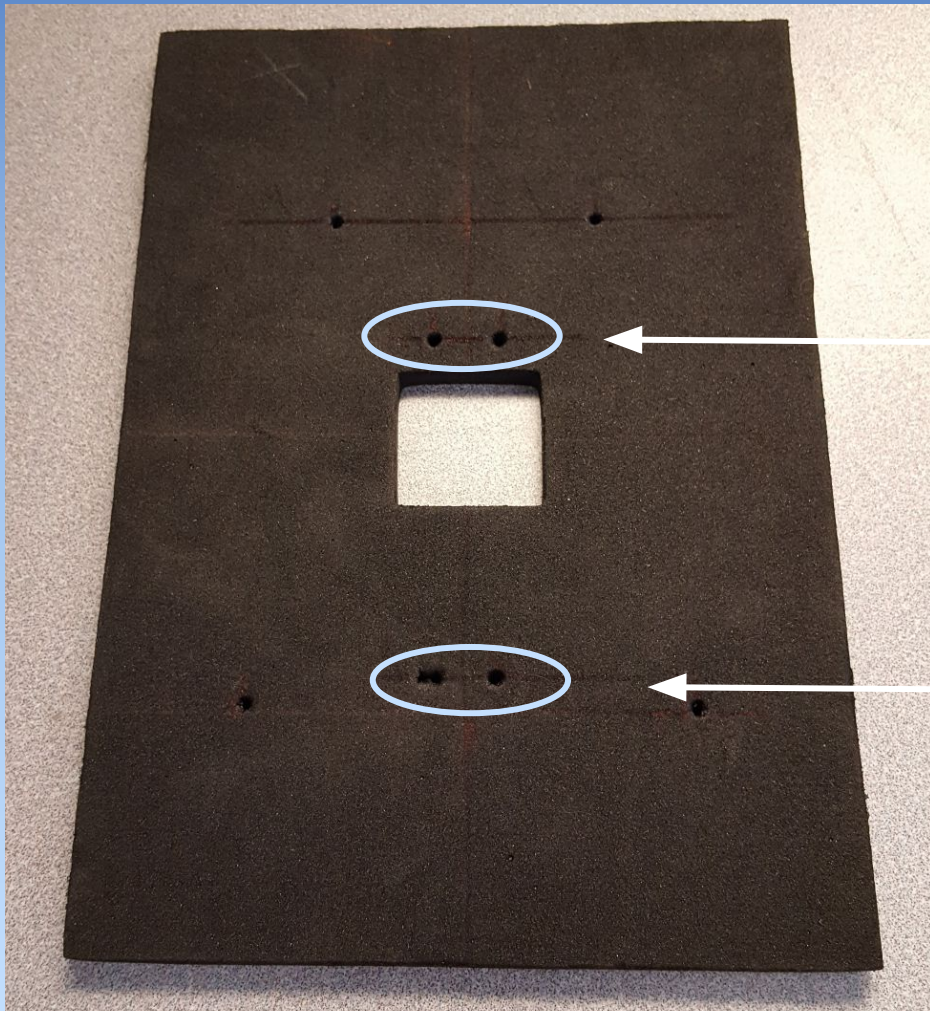


**So, think through what you want your Balloon Car and maybe draw a quick sketch to base your design off of!**

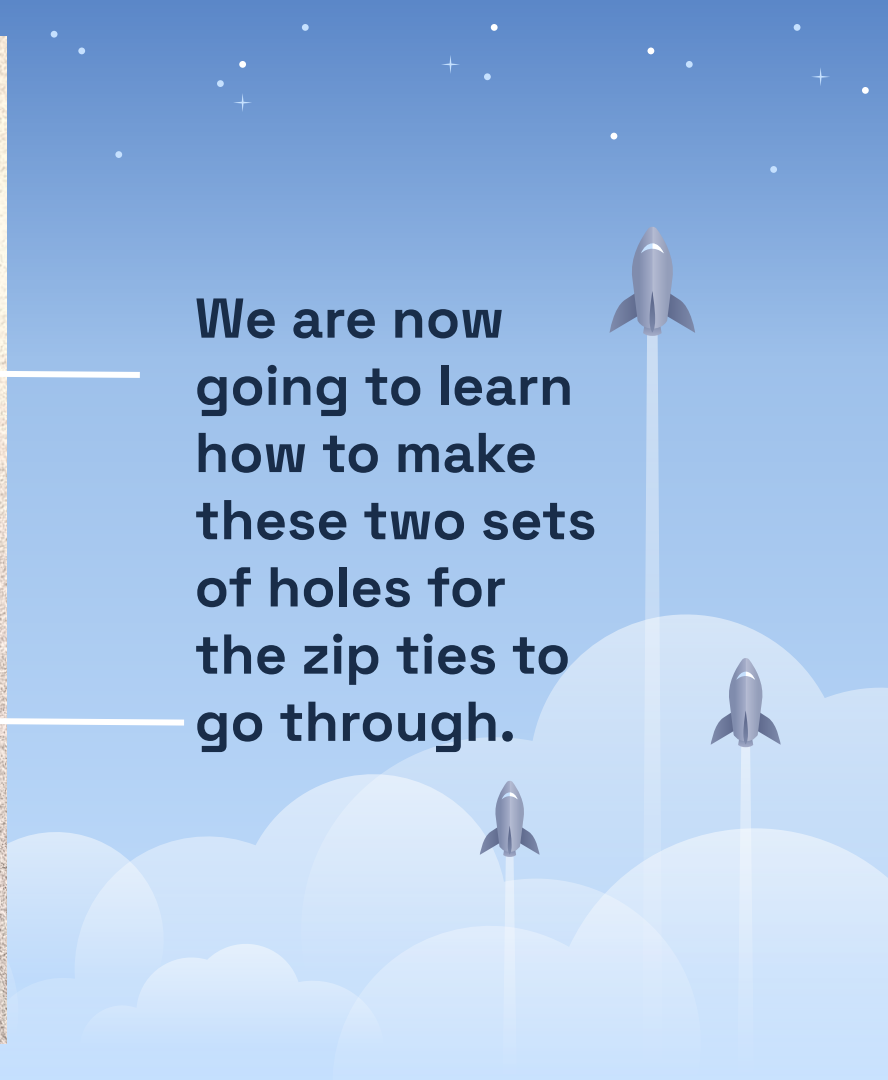


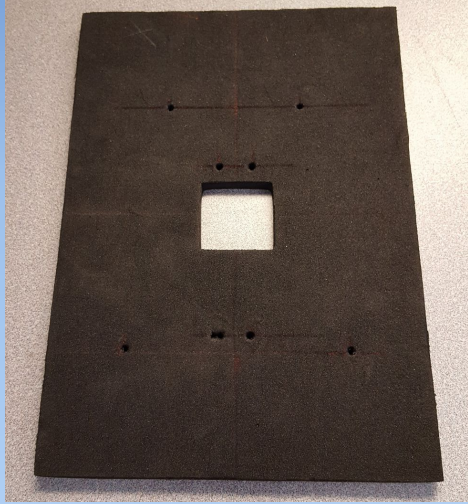
Be very careful with  
the scissors!



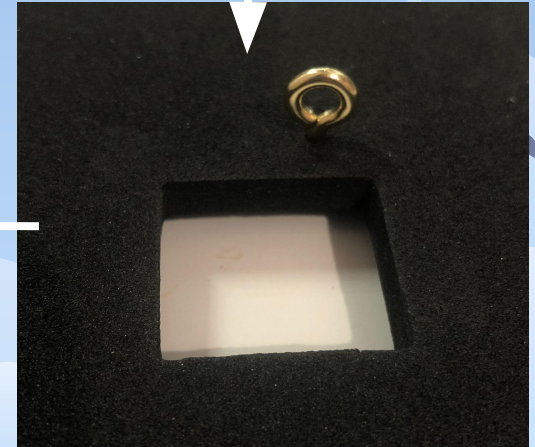
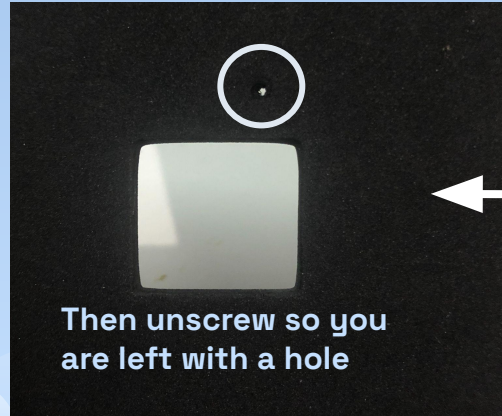
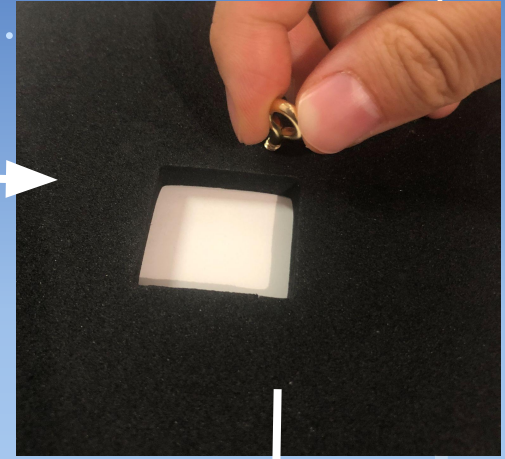
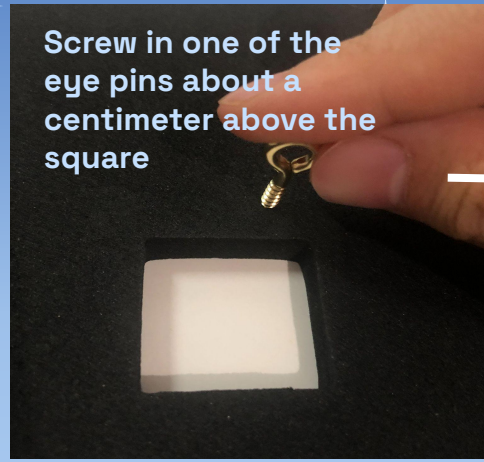


**We are now going to learn how to make these two sets of holes for the zip ties to go through.**





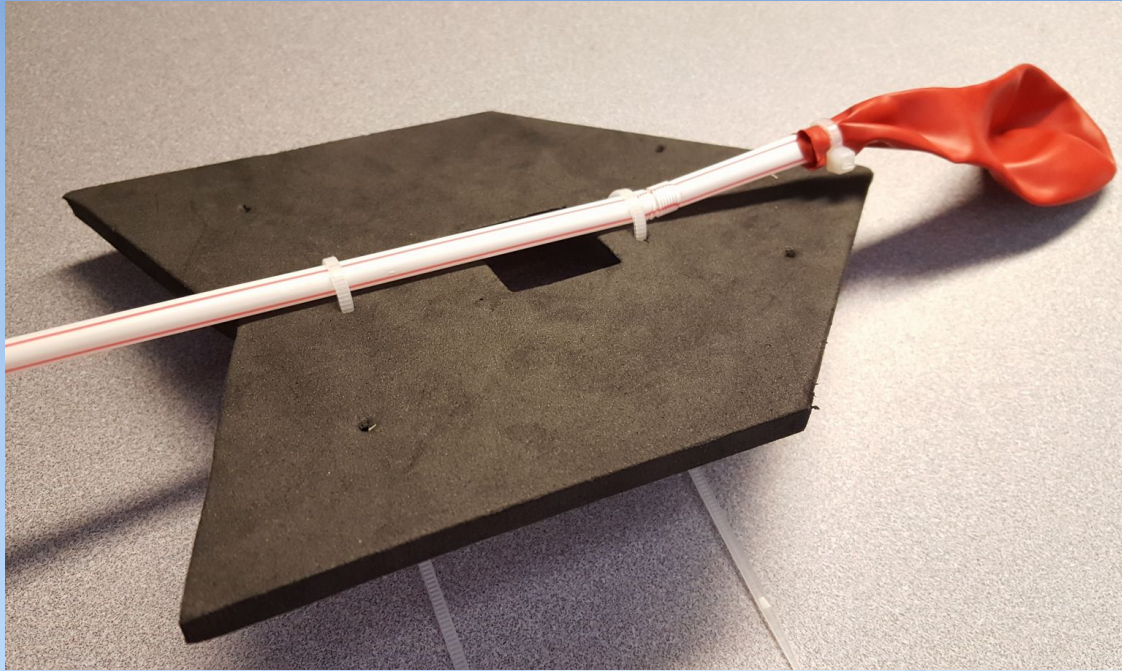
**Make sure the  
foam board is  
in a vertical  
direction!**



Repeat this process so that you have four holes. Two above and Two below the square in the middle.



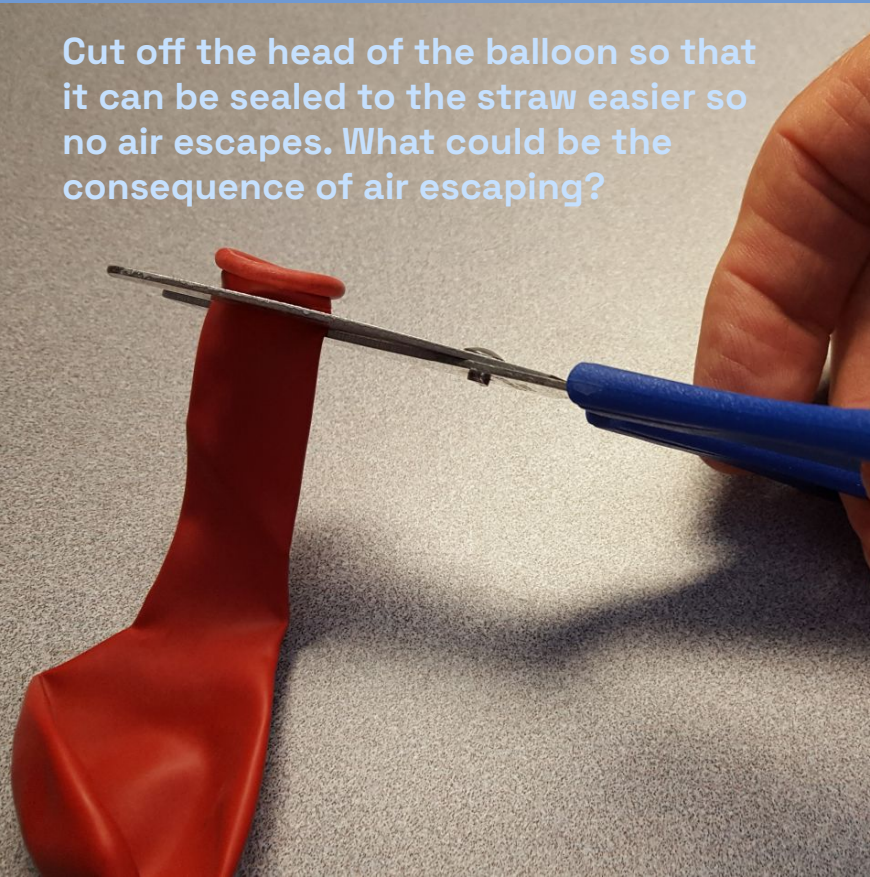




We are now going to add our balloon to the car. Why is the balloon important? It is what gives our car force so that it can move!



Cut off the head of the balloon so that it can be sealed to the straw easier so no air escapes. What could be the consequence of air escaping?

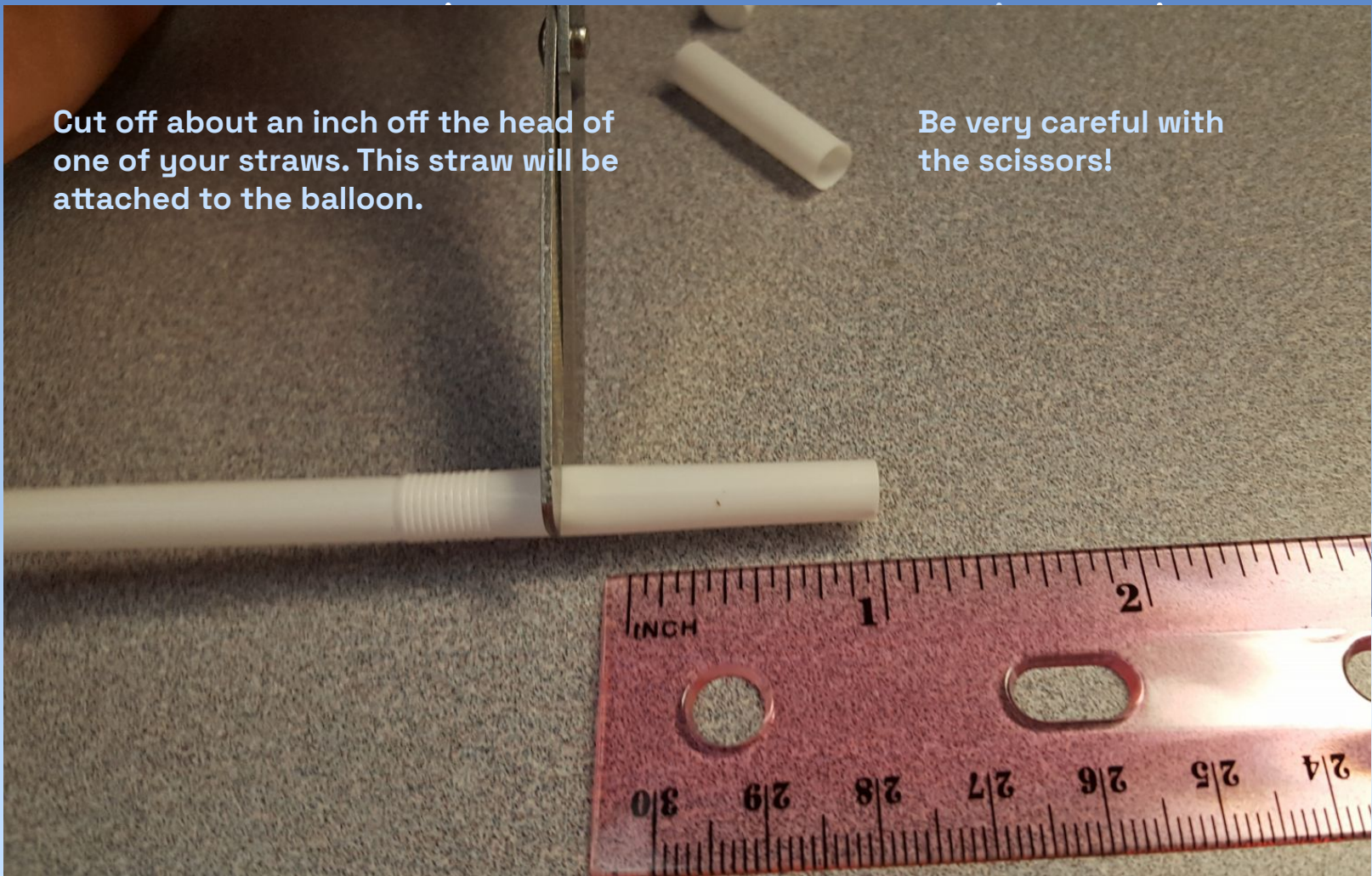


Be very careful with the scissors!

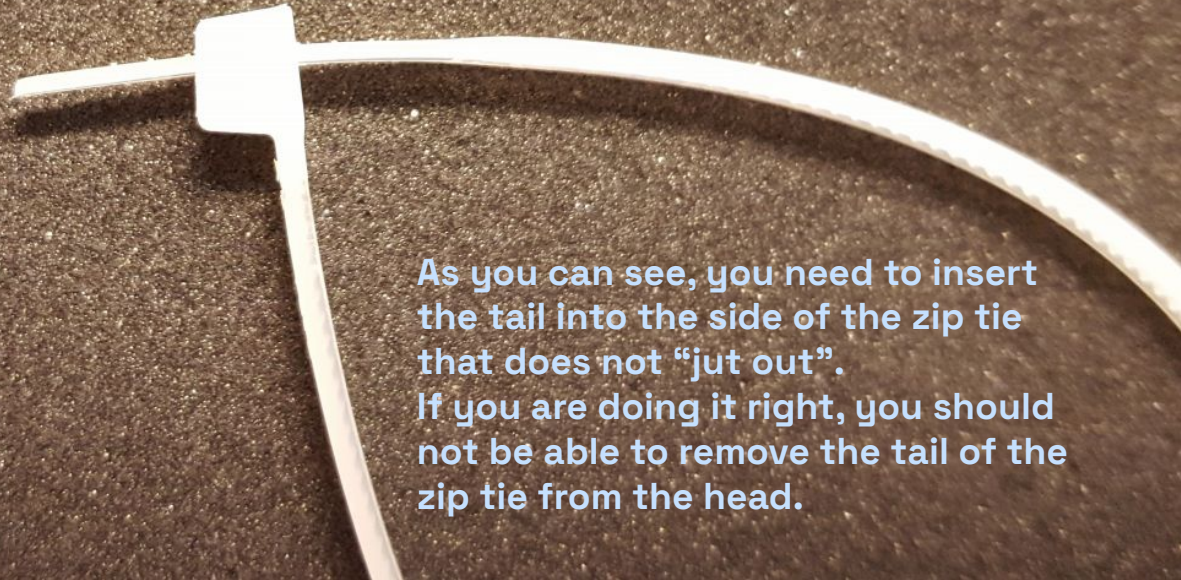


Cut off about an inch off the head of one of your straws. This straw will be attached to the balloon.

Be very careful with the scissors!



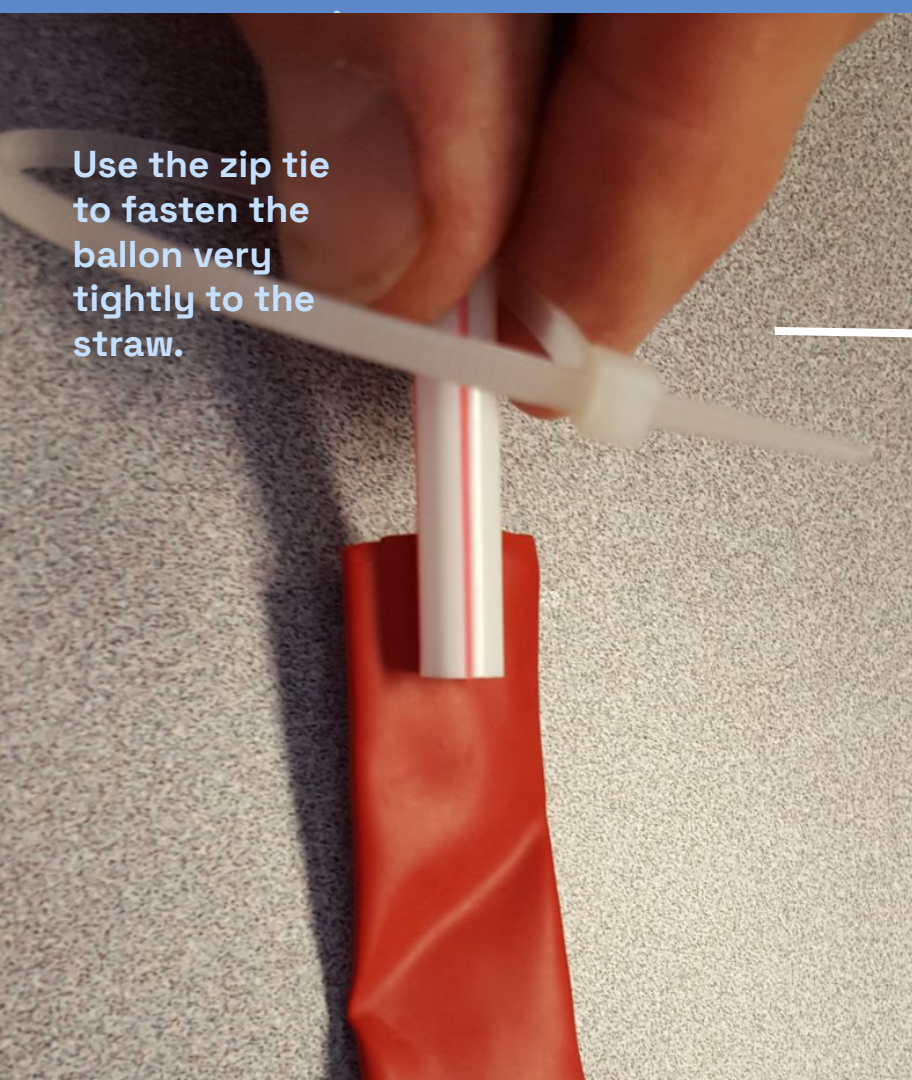
Take one of your zip ties and observe its orientation. There is a very specific way of tying zip ties so that they stay.



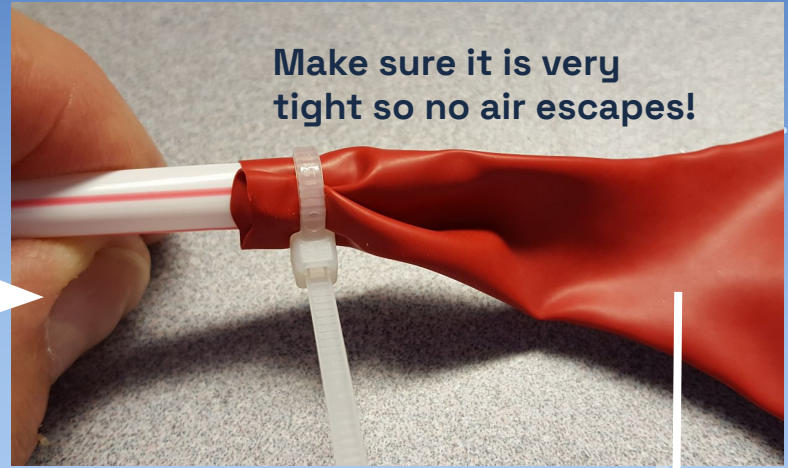
As you can see, you need to insert the tail into the side of the zip tie that does not “jut out”. If you are doing it right, you should not be able to remove the tail of the zip tie from the head.



Use the zip tie to fasten the ballon very tightly to the straw.



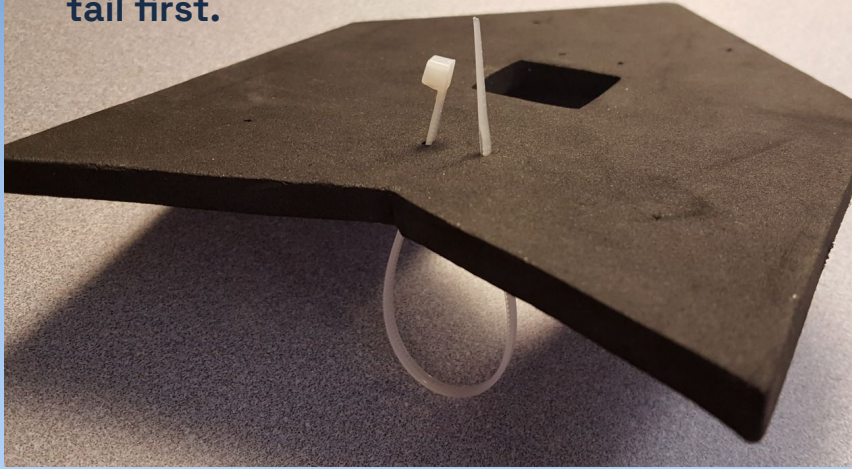
Make sure it is very tight so no air escapes!



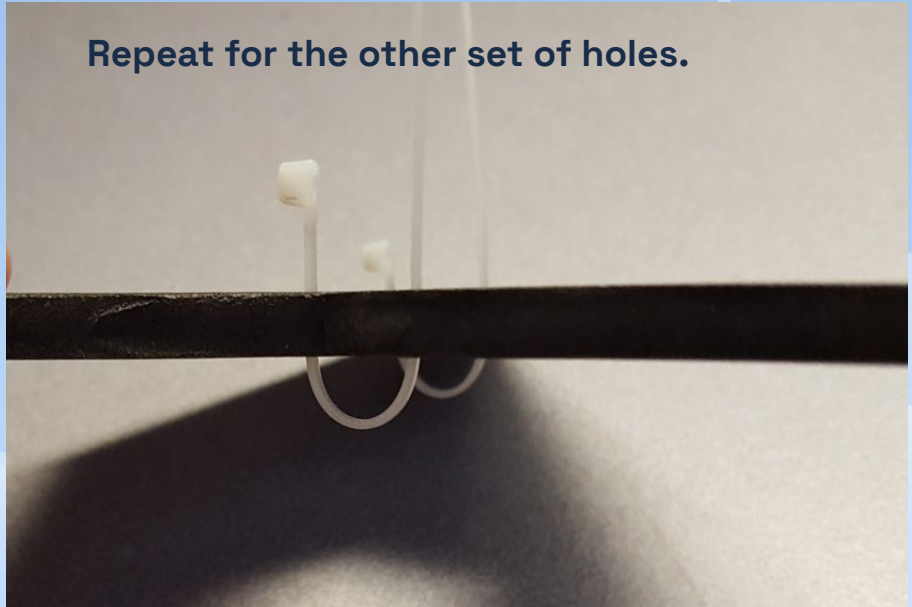
Cut off the excess tail of the ziptie. Be careful with scissors!

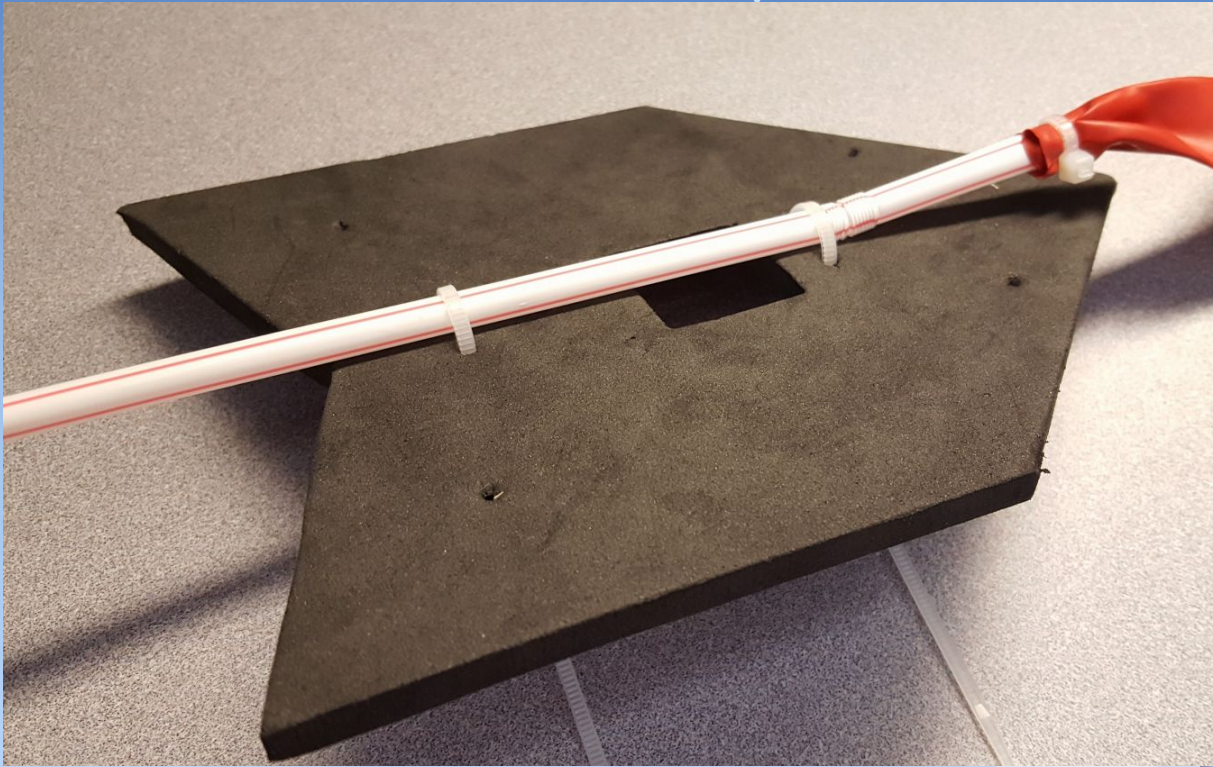


With the two sets of holes made earlier, thread the zip tie in like so tail first.



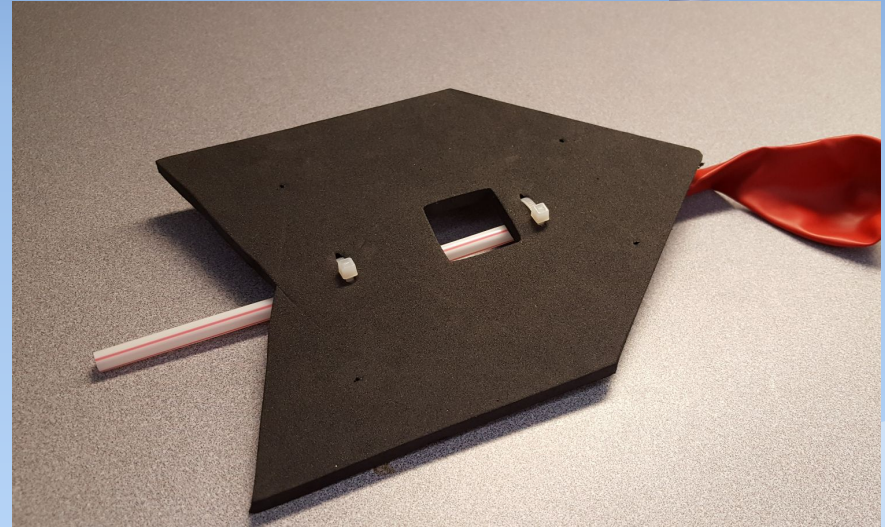
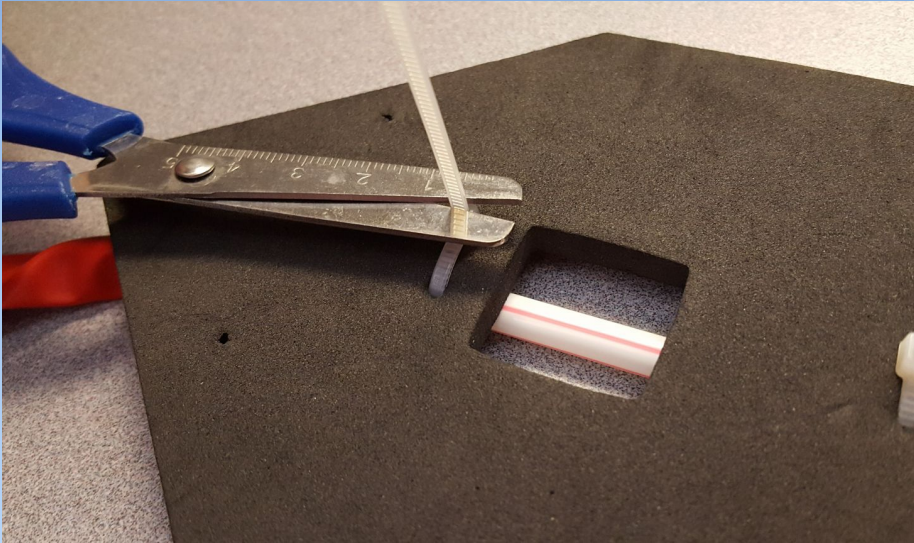
Repeat for the other set of holes.



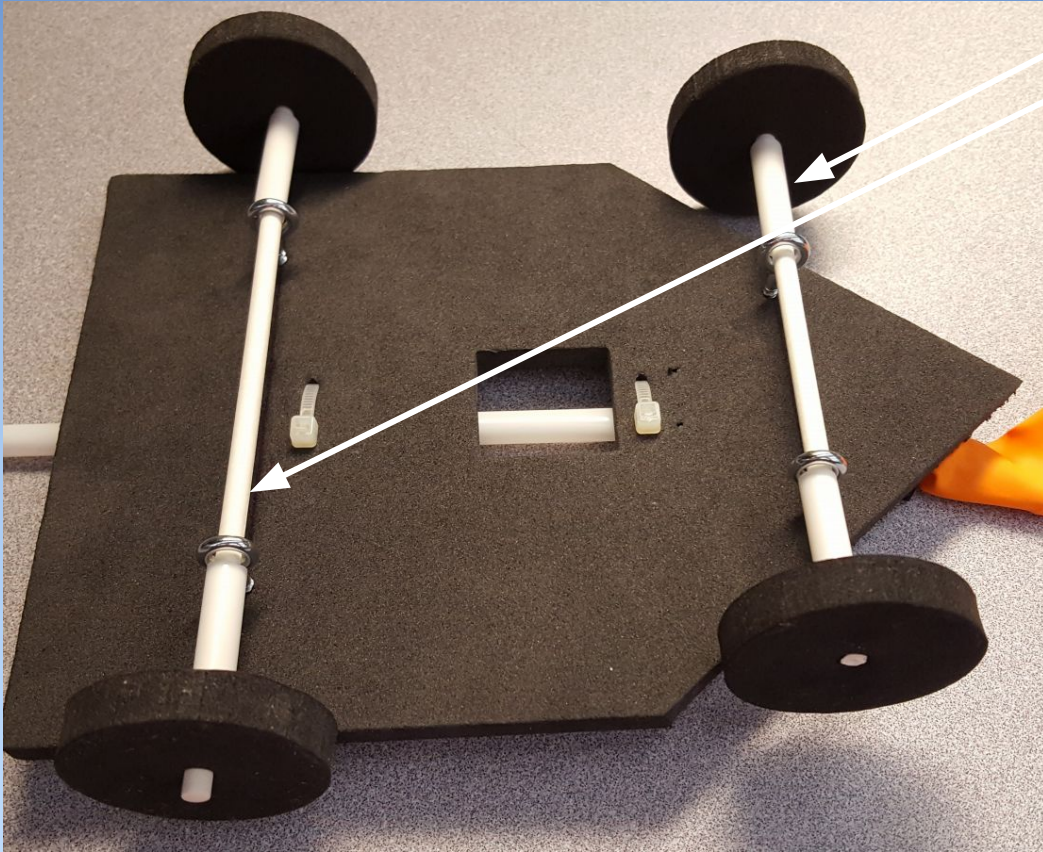


Slide the straw with the balloon in (be aware of the direction you do this in. Remember: the balloon should sit on the front of the car because the car travels in the direction opposite of the air leaving the straw). Then, tie off the zip ties. No need to do them too tight, just make sure the straw is secure.

Cut off the excess tails on the zip ties.







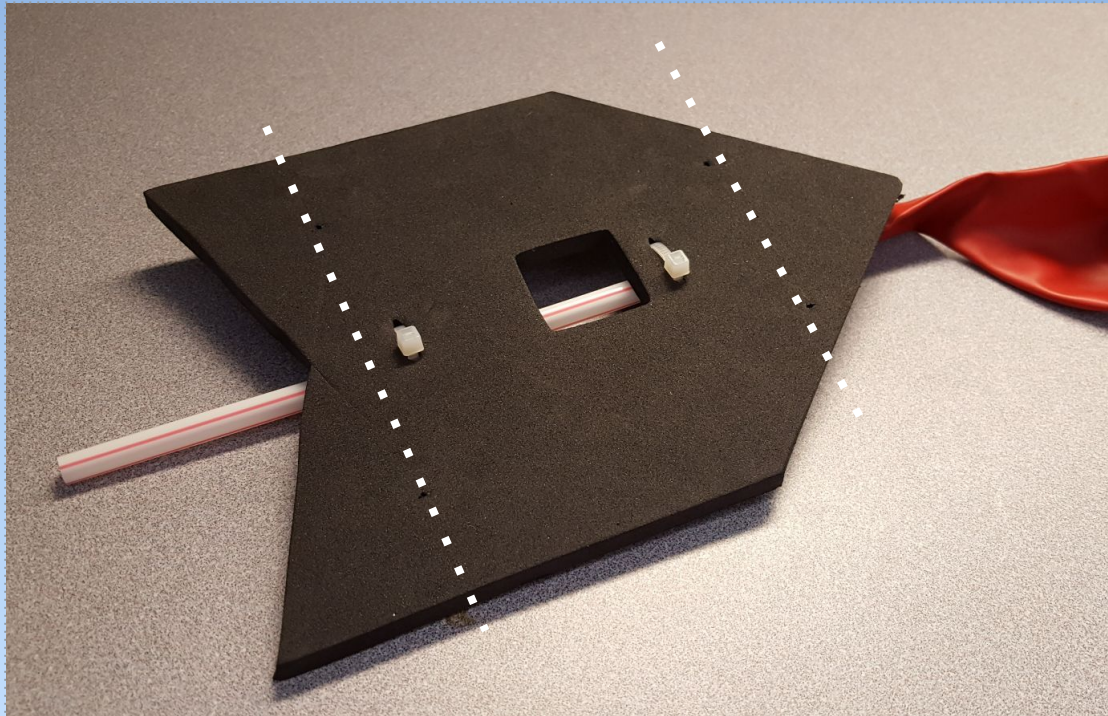
axels

**Next up: Wheels!**

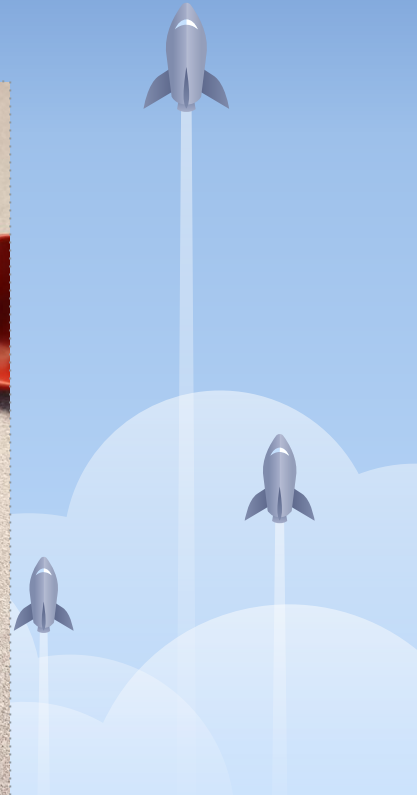
**Think: Where do you want your axels to be? Do you want them to be close together? Far apart?**



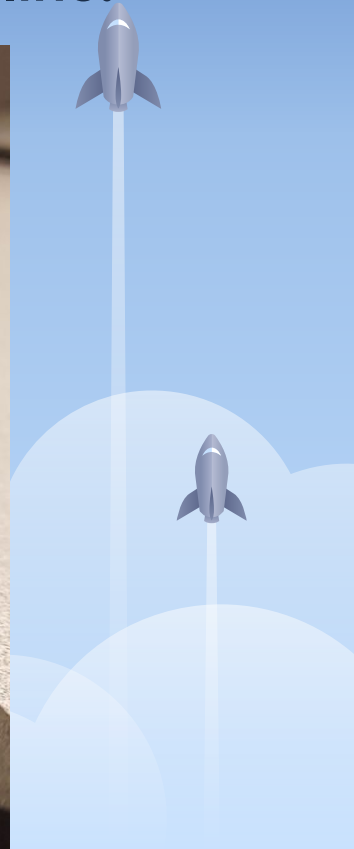
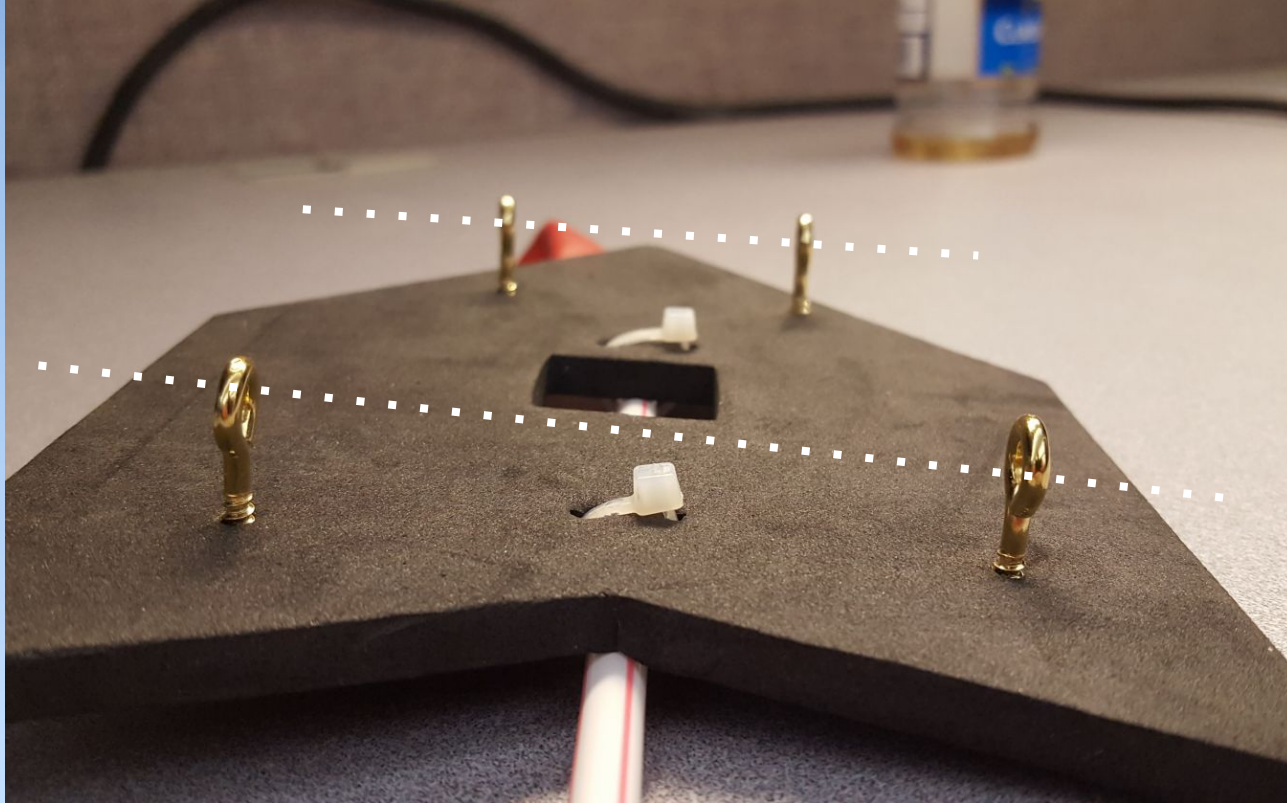
On the bottom side of the car (the straw/balloon are on the top side), draw with a pencil where you want your axels to be. Here's an example:



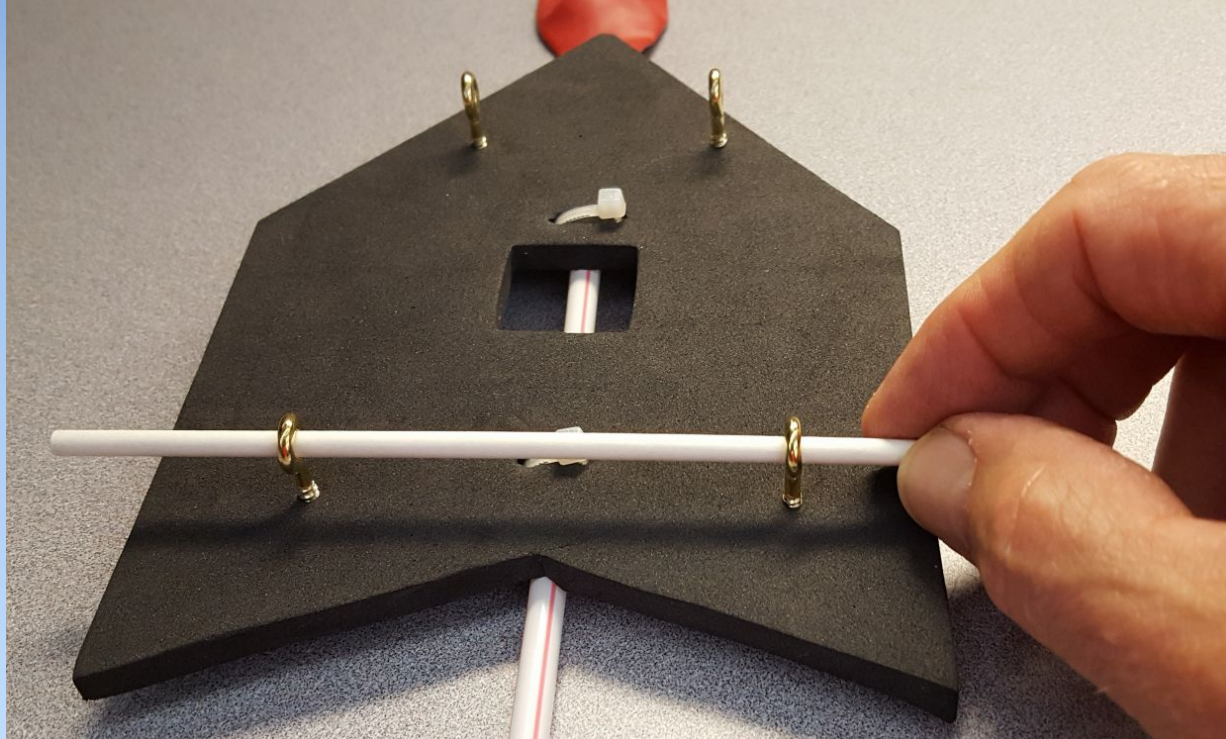
**Axels should be parallel!**



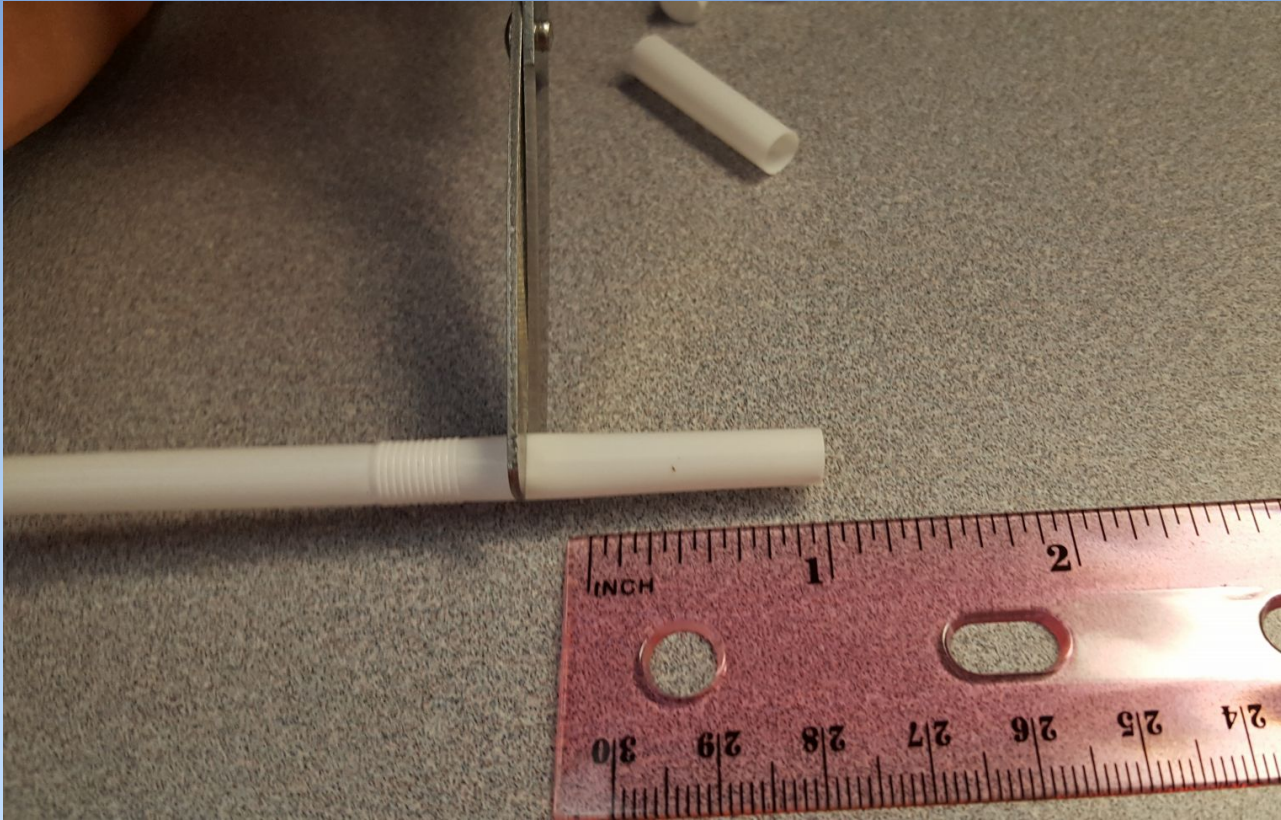
Screw in each of the four eye screws along your axis lines so that you can imagine each axel going through two key screws as shown by the dotted line.

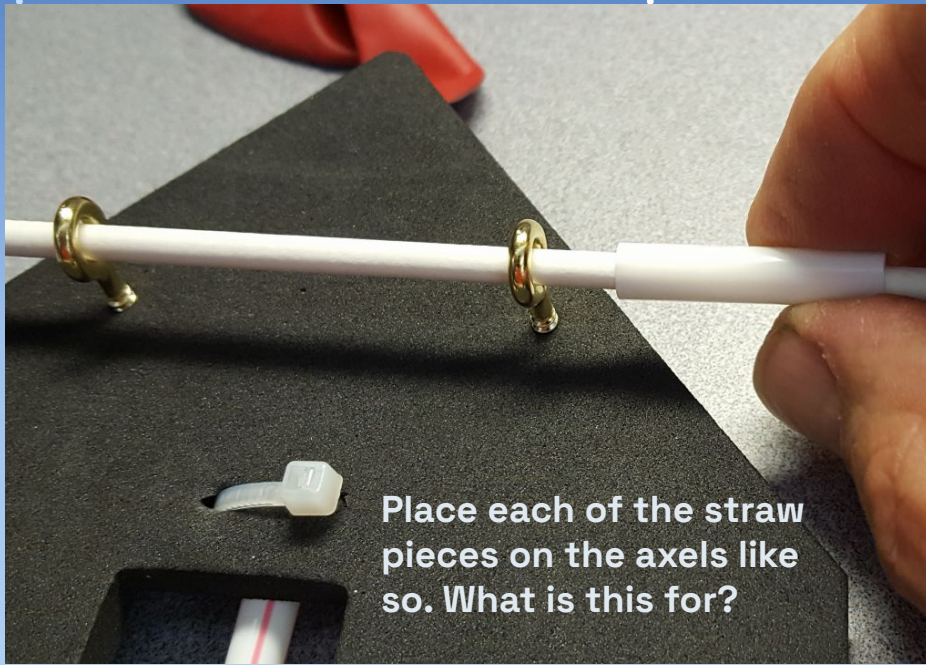


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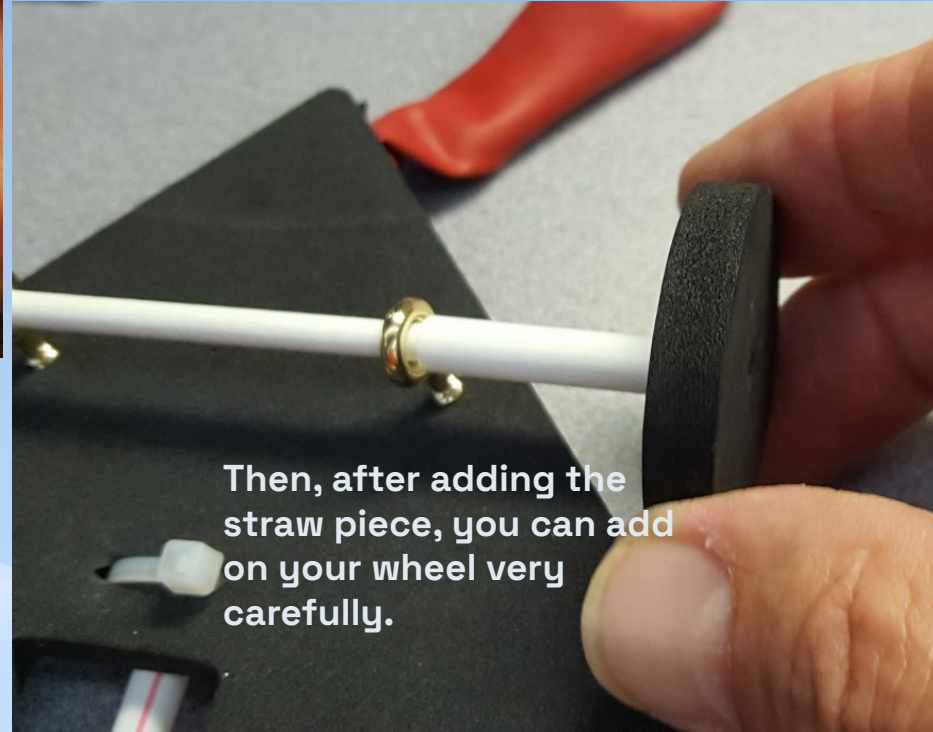


With your other straw, cut 4 pieces of straw about one inch in length. Be careful with the scissors!



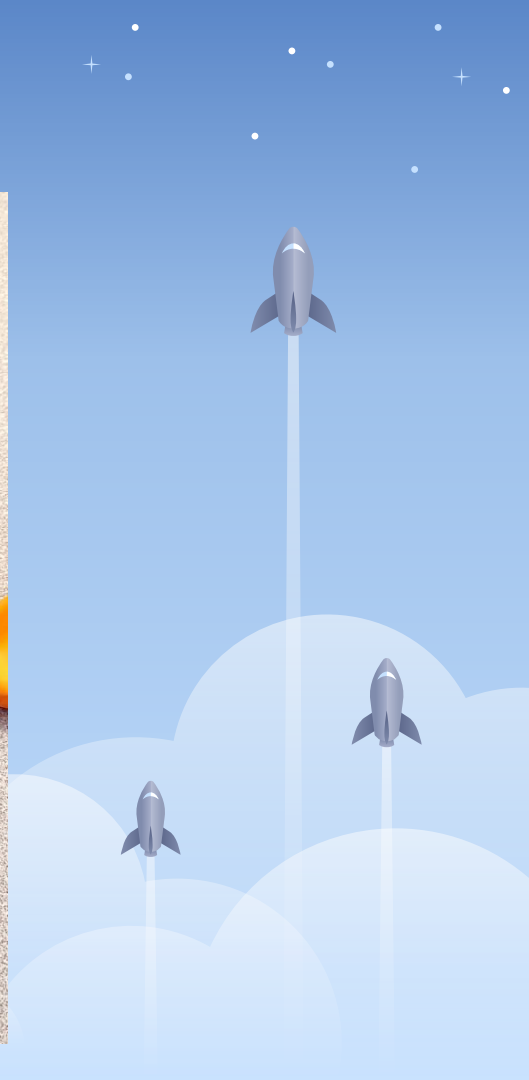
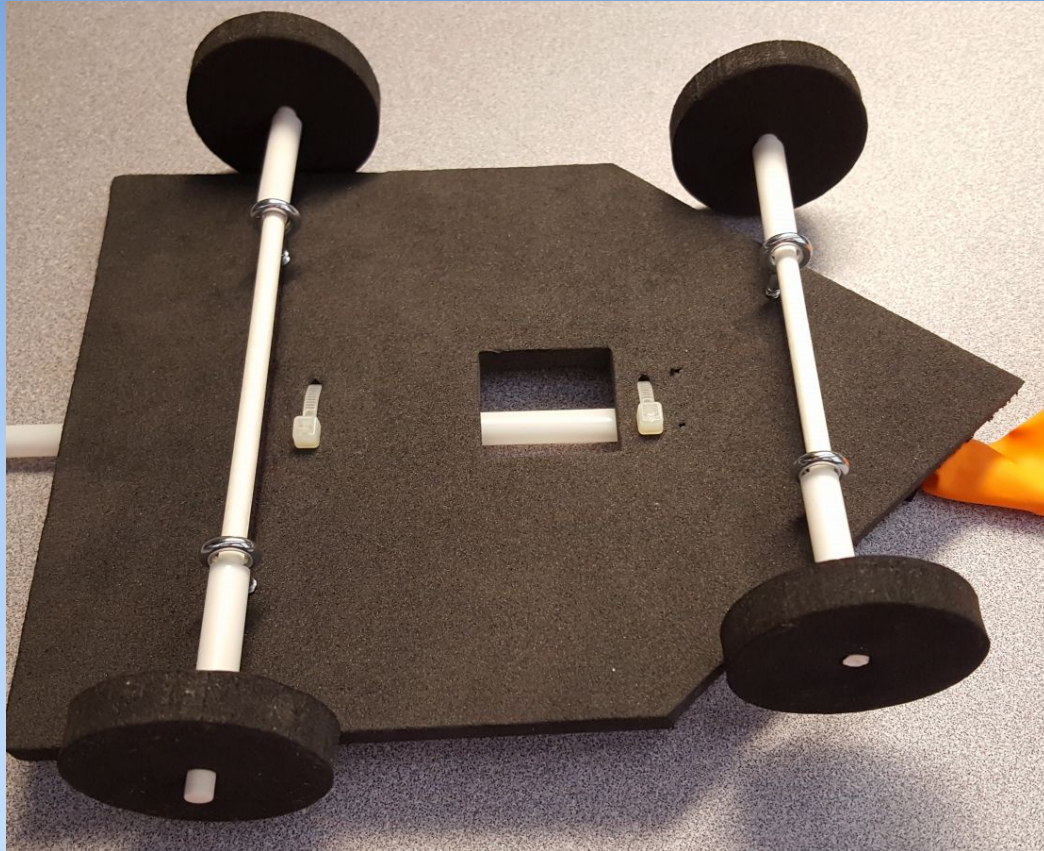


Place each of the straw pieces on the axels like so. What is this for?

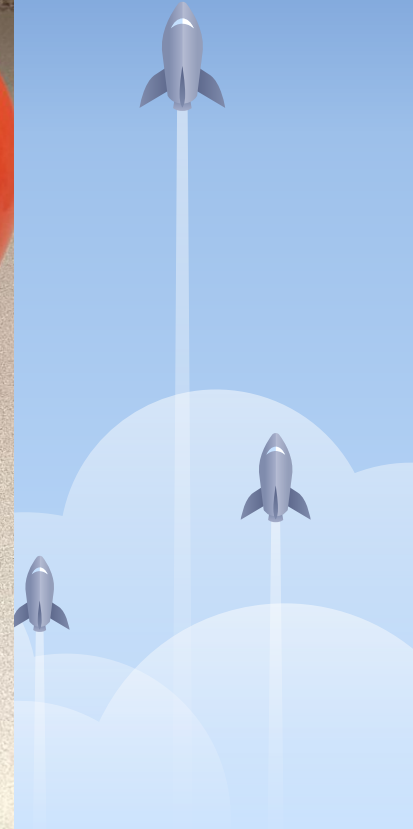
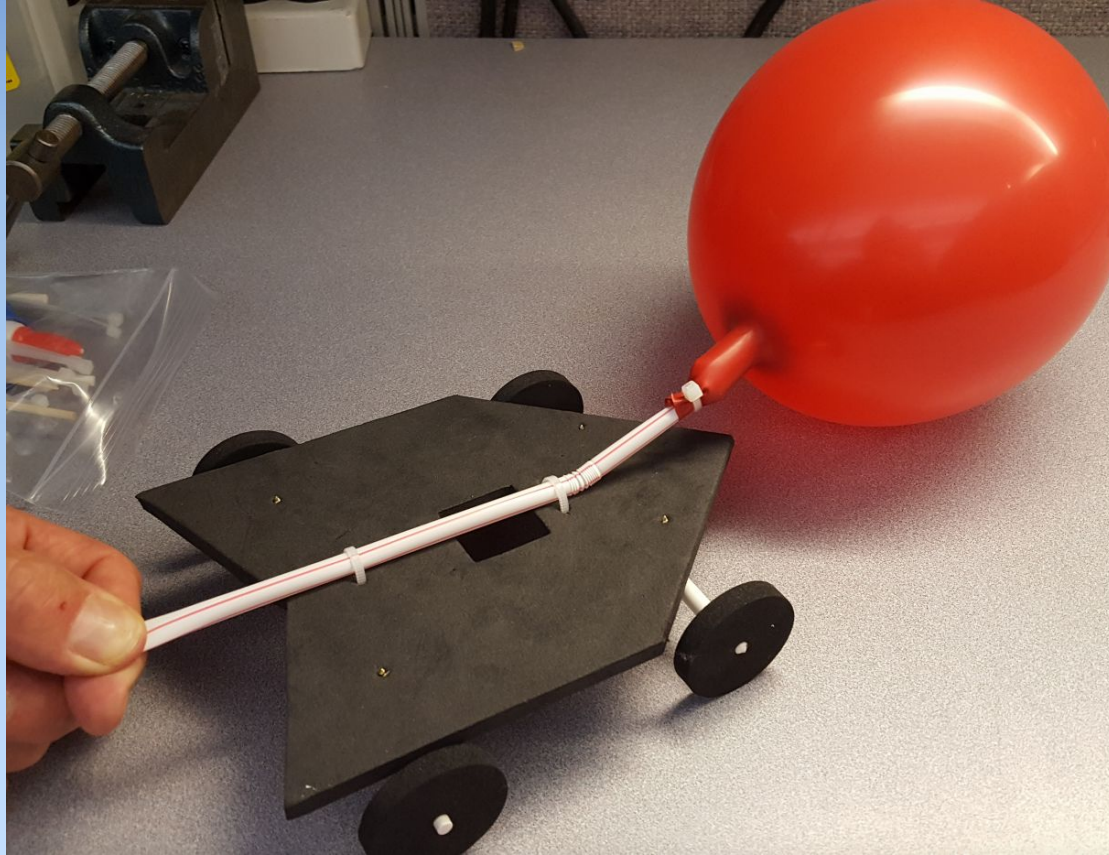


Then, after adding the straw piece, you can add on your wheel very carefully.

Repeat for each of the four wheels.

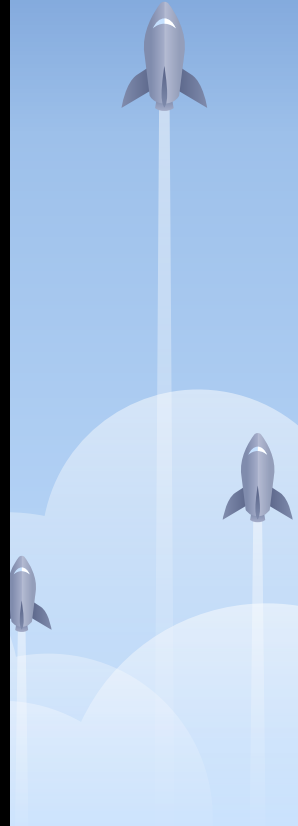
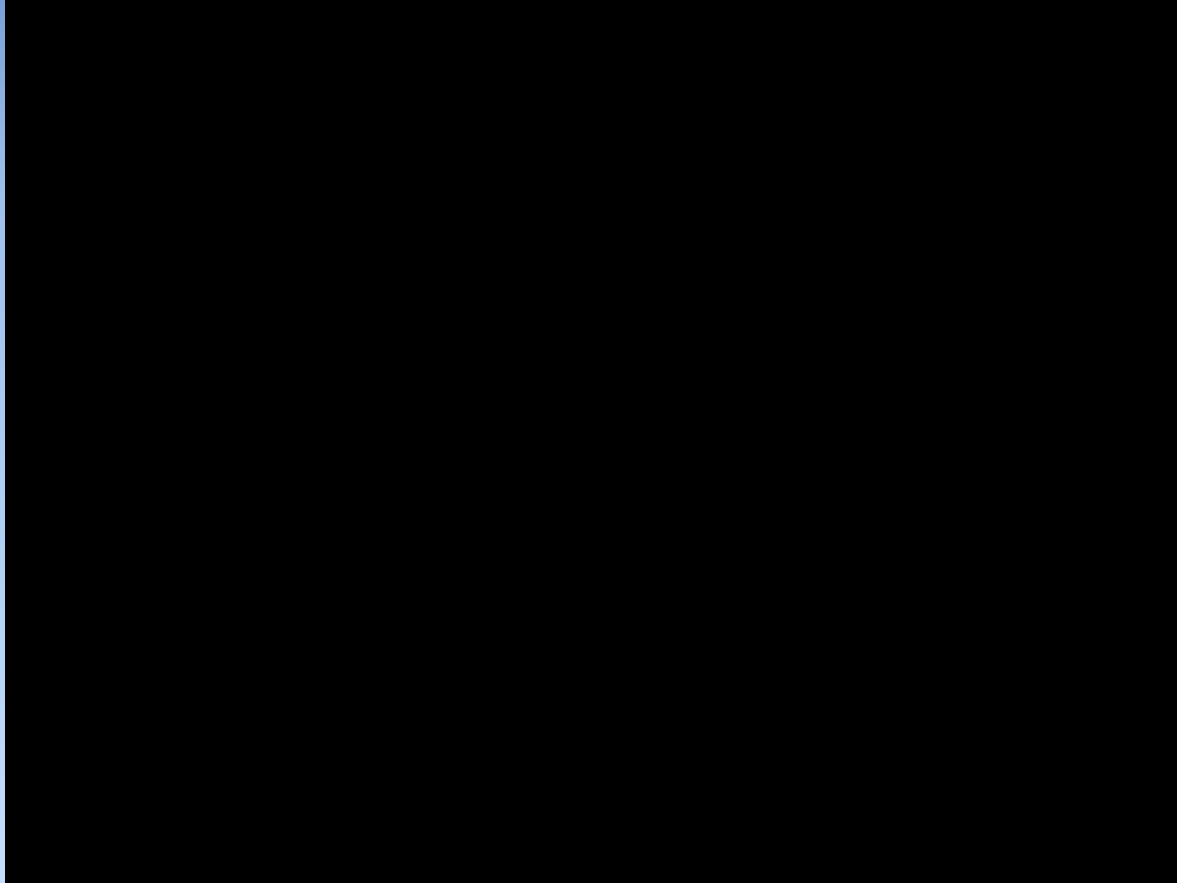


You are ready to blow up your balloon and try out your balloon car!





**You are ready to blow up your balloon and try out your balloon car!**



# Troubleshooting:

A huge part of the scientific process is identifying and correcting errors. What are some common errors from this experiment?



Why won't the car go very far if the straw is angled up like this?

Think about “every reaction has an equal and opposite reaction”. Since the air is leaving the straw at an angle, not all of the force is used to propel the car horizontally.

If the straw is flat, more of the force is used to propel the car horizontally which will make it go farther!



# Send us a video of your Balloon Car!

We really want to see all your cool designs so we will be holding a fun little Balloon Car Competition with two prizes:

- 1) Fastest/Farthest traveling car
- 2) Most creative/unique design

Please ask your parent to send us a video of your balloon car to our email address: [togetheraboveallofficial@gmail.com](mailto:togetheraboveallofficial@gmail.com) for the chance to win a small prize of a gift card!