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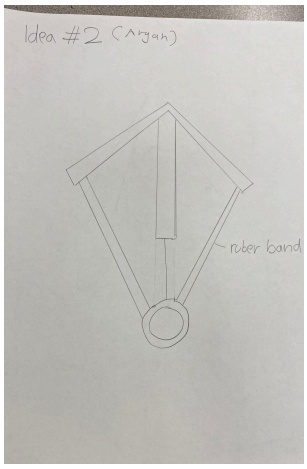
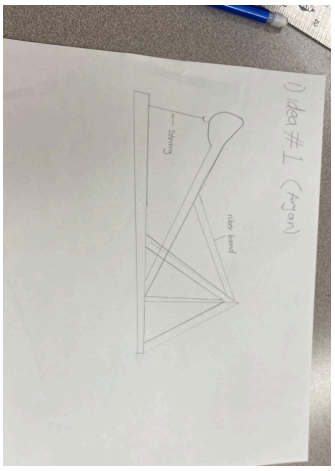
Engineering Notebook
Droid Catapult Challenge
Ms. Kamen / Ms. Edore

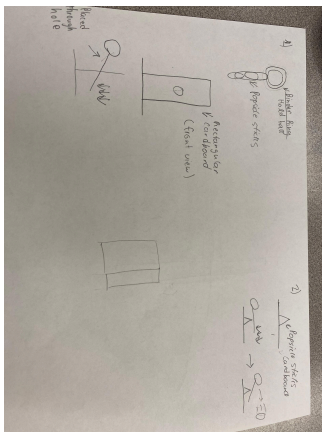
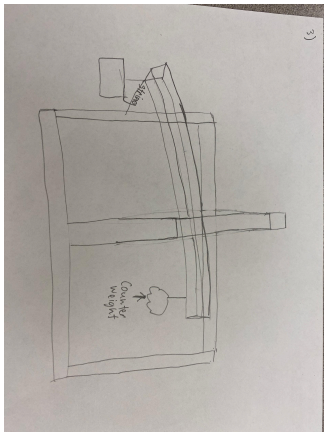
Day 1: October 13, 2021

We have to create a catapult that can launch our droid back to the ship, today we are going to create some designs for the catapult. We need a catapult that can launch the droid accurately and something that has power and can launch it fast. We have created some basic designs that can best fit our needs.

- We came up with a total of 3 ideas.
- The first being a simple catapult in which applying force on the bottom half of the lever arm will send the ball flying. The downside to this idea is its inconsistency. It will not be able to run the same distance each trial.
- Our second Idea was a catapult that resembled a crossbow. This will definitely be capable of launching the ball in an arched trajectory.





Concept 1: Concept 1 is a really basic design for a catapult, but the most functional as well. The catapult would be made out of mainly popsicle sticks, and the string at the end of the catapult will restrain the ball from launching, once we remove the string the rubber bands will pull the stick where the droid is placed and it will launch the droid into the “ship”

Concept 2: A catapult with a crossbow-like structure. It has a good design and should have good accuracy. The catapult will be built out of popsicle sticks and the rubberband will be looped around the ball so it can give it a lot of power when it shoots, it will also have a hook that is stopping the droid from launching.

Concept 3: This catapult will use a counter weight to fire the ball in an arched trajectory .

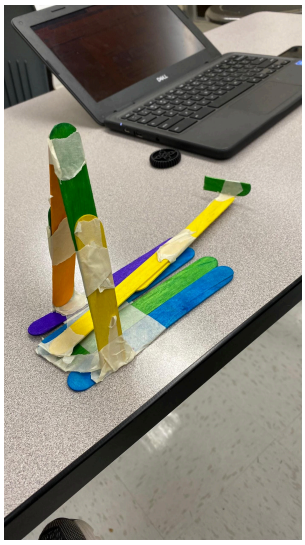
Concept 4: Simple catapult in which applying force on the bottom half of the lever arm will send the ball flying. The downside to this idea is its inconsistency. It will not be able to go the same distance each trial.

	Priority 1 (Functionality)	Priority 2 (Design)	Priority 3 (Durability)	Priority 4 (Accuracy)	Total
Concept 1	5	5	4	4	**18**
Concept 2	4	5	3	5	**17**
Concept 3	4	4	5	3	**15**
Concept 4	5	3	5	2	**15**

<u>Day 2: October 14, 2021</u>

- Today based on the total score we decided to build a prototype of 2 designs:

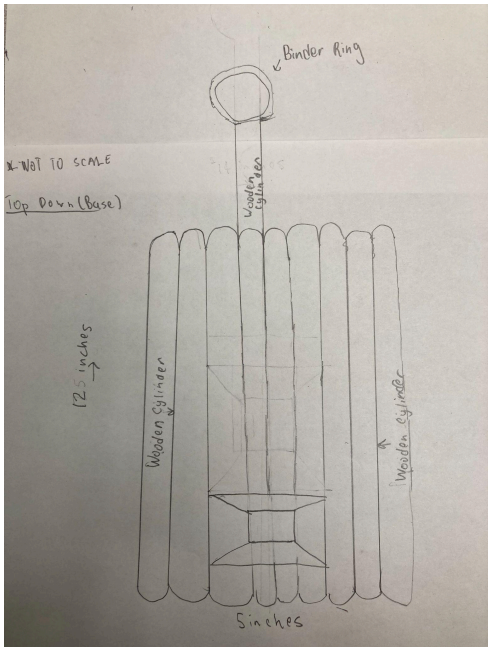
- The first, followed the design of a more traditional catapult. And was able to launch an object 5 inches.
- The second prototype, however, was ineffective and can not be constructed effectively. Here is an image of the prototype we created:

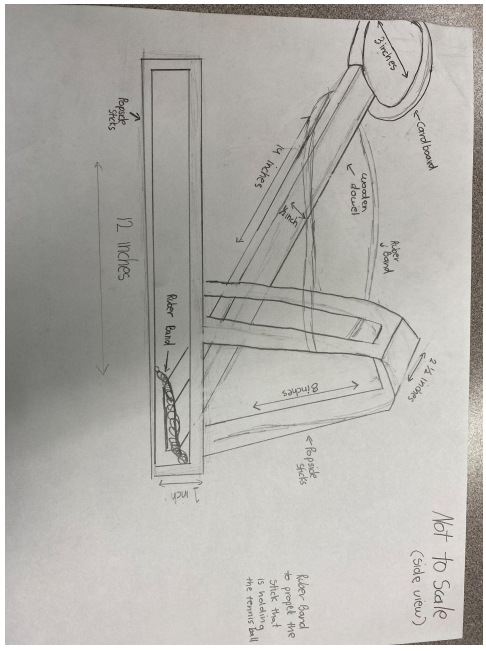


Day 3: October 18, 2021

Today we decided to build out final sketches and we made some modifications to our original design.

- They included a top down, and side view of the model.
- Each includes labels of the materials used as well as measurements. These sketches are show below:



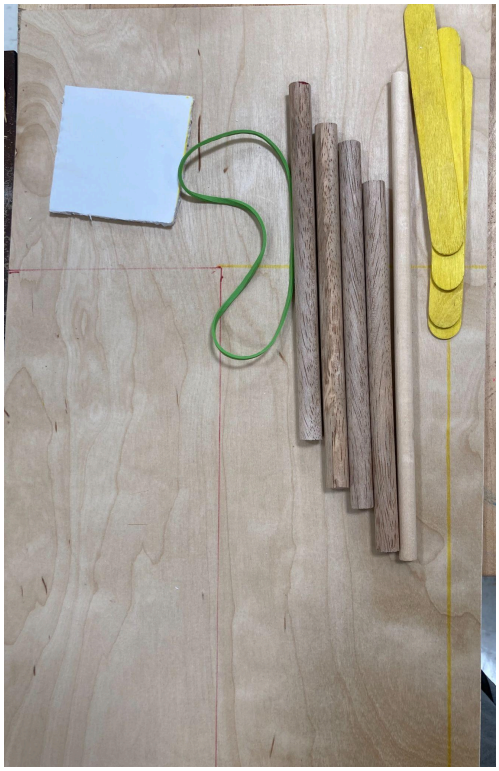


- We then scanned the room for materials that would eventually be used to complete our project.
- The following materials were considered:
    1. Popsicle sticks.
    2. Wooden dowels
    3. String
    4. Small wooden planks

These materials were picked so that they would be able to construct something that is at least 12 inches in length and at most 14 inches in height.

Day 4: October 19, 2021

Today we attempted to build our catapult, because there was no electricity, we had to manually cut out the pieces .Instead of making the main stick that flings the catapult 14 inches, we made it 10 ½ inches and we think it would be better in the long run.
Here is the stuff we worked on:



Eventually, we plan to attach the wooden dowels to the surface of our base. The popsicle sticks will act as support for the Arm and the rubber band will be used to launch the catapult with great force.
Problems left to resolve/questions left to consider :

- How will we be able to reliably attach the wooden dowels to the surface of our base?
- Popsicle sticks are fragile and may break during construction or usage

Today was an extremely productive day since we were able to gather and create the main pieces of our project.

Day 5: October 20, 2021

Today we cut out our base. Originally, we were going to use two pieces of wood but because we didn't have access to the band-saw, we just decided to use one piece of wood for our catapult.

- The base is 12in x 5 in and will hold several components of our catapult.
- We used a hand saw to cut it, with masking tape as guidance.
- It will act as the main center for the pieces of our catapult.
- We did the cutting manually with the use of a handsaw.

Most things will be placed in the first half of the bast (first 6 inches). There needs to be space in the lower half of the base to provide space for the arm of the catapult to be pulled back.

Day 6: October 22, 2021

Today we started to assemble our project.

- Our first priority was cutting out wooden dowels to be the perfect size. They were too long, being 12 inches, while we wanted it to be 8 inches. Using a saw we cut all 4 dowels down to 8 inches.
- After some consideration, we realized that using 4 dowels would not allow us to accurately launch the tennis ball. 2 wooden dowels is the best choice.

Day 7: October 25, 2021

- After gluing on our front wooden dowels, we realized that they weren't strong enough on their own. We supplemented them with hot glue and popsicle sticks.
- This allowed it to stay in place when the tennis ball was being fired.
  Here is the support system we created:
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Day 8: October 28, 2021

- In order to hold our arm in place, we used a small piece of cardboard to hold it in place.

- This piece of cardboard was placed near the front of our base which allowed the arm to move freely.

Day 9: October 29, 2021

- Since, cardboard didn’t work at holding our arm, we thought that tape would be the answer. However, the tape was not strong enough to hold the arm either.
- String was our next material use, however it was not strong enough to hold the arm in place.

Day 10: November 1, 2021

- After realizing that tape and string were ineffective, we decided to use a plastic straw.
- By attaching our arm to a plastic straw, the arm would be able to move in a circular motion. This generates force for the tennis ball.
- The straw was placed around a thin piece of wood, which would allow it to spin.
- We used glue to attach the arm to the straw.
- The only downside to this idea was that the hot glue that held the arm and straw together, is not quite strong enough.o

Day 11: November 3, 2021

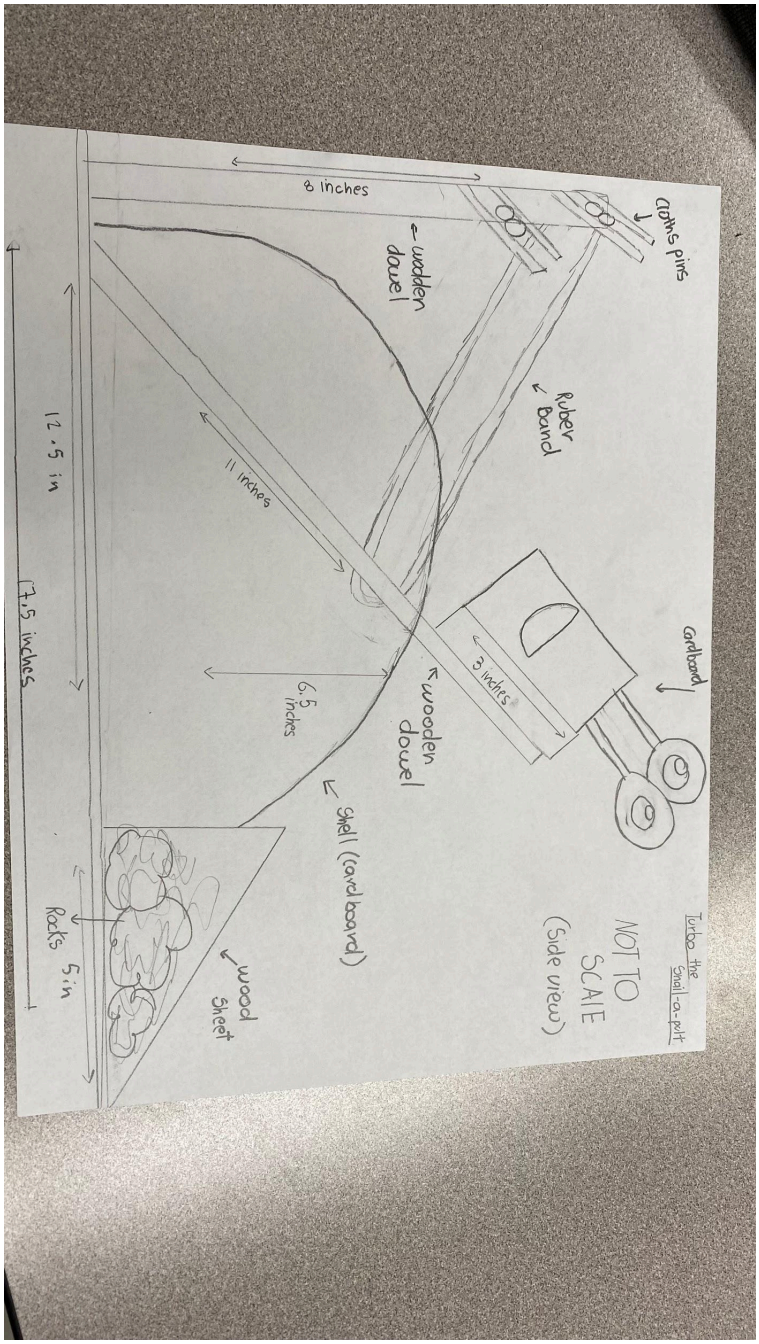
- After the catapult worked on its full capacity and launched the ball 10 feet, the whole thing fell apart. When we launched the ball, one of the sticks holding the rubber band in place fell off and the stick holding the ball also fell.
- After that we realized that hot glue wasn't strong enough and we needed to make the catapult more sturdy.
- We added some more hot glue and put 2 nails at the bottom of the stick holding the rubber bands and it worked.
- For the stick that was launching the ball, we put some more glue and some tape to make it more durable and it worked.
- We launched the ball and it successfully made it 10 feet without falling apart.

Day 13: November 9, 2021

- Today we decided to make the catapult more appealing by adding some cardboard on the side and some eyes on the top to make it look like it was a snail.

Here is Turbo the snail-a-pult

Day 14: November 15, 2021
Final Sketch:



Day 14: November 18, 2021

- After completing our final official test, we were able to launch the ball accurately and precisely 20/20 times with perfect accuracy. With each launching, the ball landed within the box.

- We learned that the process of building something takes a lot of time. Our process was mostly trial and error; if something went wrong we simply got more materials and started testing. We went through every single part of the design and engineering process.
- If presented with another project such as this one, here are some things we would do differently:

  We would do more brainstorming. Some more Brainstorming would have saved lots of time and effort when compared to testing only.

  We would use less fragile materials because they made testing much more difficult. A lot of times the stick that was holding the rubber bands came off our build. If we build this project again, we would definitely make the whole snail-a-pult a lot more sturdy, using stronger wood and glue it on with wood glue instead of hot glue (wood glue is a lot stronger, but takes a lot of time to dry)

  Here is our final build of our snail-a-pult:

  I present you **TURBO THE SNAIL-A-PULT**

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