

# Snoop's Doggs

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Paige Schultz



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# Planned Machine Design Sketch and Description

## Day 1: assign team rolls:

Handbook expert: Paige Schultz

Photography: Courtney Graves, Ellen Dorist

Journaler: Annie Hjelle, Bridget Bottineau

Sketcher: Katrina SanTERS

create groupchat ☒

### Theme Brainstorming:

- Guardians of the Galaxy
- space cowgirls
- time-line, vision into the future
- Put our faces in the future portion
- space vikings

### chemical reaction category:

- elephant toothpaste
- smoke reaction
- lava lamp
- combustion / concave barrel

### Sectioning of build:

3 - past, present, future

Past: history of women in space engineering

Present: women now in space

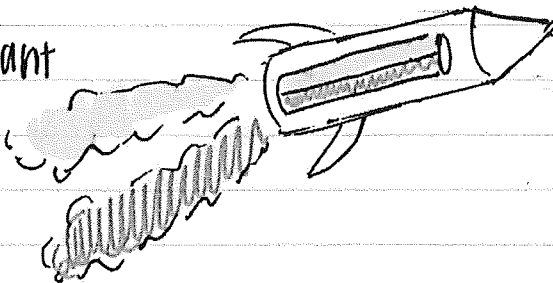
future: our future in space & engineering

maybe  
black &  
white



Base construction  
(10/7 - 10/14)

elephant  
toothpaste  
reaction





10/14/22

Day 2:

\* Important concept: work on connecting the time line in a different way, not just step 1  $\rightarrow$  2, 2  $\rightarrow$  3, 3  $\rightarrow$  4, Try connecting step 1  $\rightarrow$  4  
When you reach step 10, it triggers something from step 3 (revisit & connect)

- Utilize women in STEM & space innovations / travel
- Play to our strengths of our all-women-group

- Start with hidden figures? "~~Python~~"

Ripple effect, start with smaller objects, end with larger

Time-line of women's involvement in space travel

- Hidden figures 1961
- Valentina Tereshkova becomes first woman in space June 16, 1963

Message  
women  
in  
the  
work  
improve

future  
pace  
travel

Split groups up  
past, present, future

Past

3

Present

4

future

4

Weekly status  
update.

- 6 milestones in each section (past, present, future)
- Redirecting asteroid

modernize - space-x, write history, ask who was first woman involved in space travel.

- Ask
- Voyagers - great great grandchildren, multi-generational space travel.

(mirror into the past)

11/4 meeting:  
choosing/assigning groups:

<u>Past</u>	<u>Present</u>	<u>Future</u>
1. Amber Hansen	1. Paige S	1. Courtney
2. Katrina S.	2. Peyton J.	2. Awa
3. Erin N.	3. Annika B.	3. <del>Ellen</del>
	4. Annie H.	4. Bridget B

-Nicole Mann - 1st Native woman to  
go to space (spaceX)

-space X mission

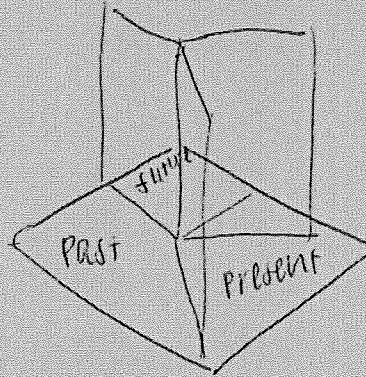
-SpaceX satellites

NASA ORG:W:

-Kayla Barron, Expedition 66

-Megan McArthur, Expedition 65

-Shannon Walker, Expedition 24/25/64/65



//  
//  
/ we owe it /  
all to you /

12/23 : split into groups and brainstorm steps

### Past:

brainstormed steps -

- 1) pulley
  - 2) hidden figures / light bulbs
  - 3) teacher space explosion (1986)
  - 4) first female piclet
  - 5) first all women space walk (2019)
- \*quotes??? - maybe talk/audio

Past rough sketch



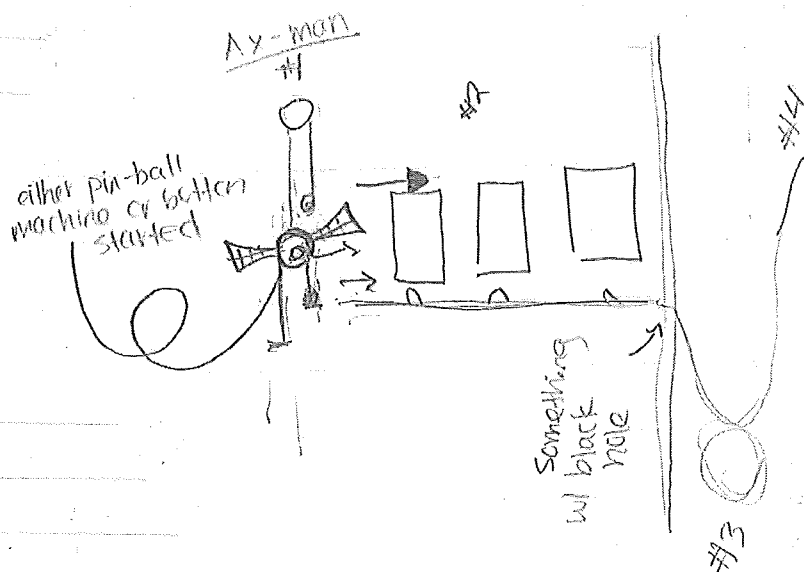
### ~~Future~~ Present:

fluid - tumbler cup (similar)

"planet balls"

silver color - makeup for water???

present rough sketches



### Future:

chemical reaction - elephant

toothpaste (colorful explosion)

Step brainstorms:

- dominoes
- car
- pump
- ball

\*rough sketch was on a whiteboard for future

marble goes into head

class tube that meets the bucket

A hand-drawn starburst or explosion-like shape with multiple points. Inside the shape, the word "FISH" is written vertically from top to bottom. The letters are drawn in a simple, sketchy style. The background consists of horizontal blue lines.

10/10/20

3/20/20

1.  $\frac{1}{2}$  of 100 = 50  
 2.  $\frac{1}{4}$  of 100 = 25  
 3.  $\frac{1}{8}$  of 100 = 12.5  
 4.  $\frac{1}{16}$  of 100 = 6.25  
 5.  $\frac{1}{32}$  of 100 = 3.125  
 6.  $\frac{1}{64}$  of 100 = 1.5625  
 7.  $\frac{1}{128}$  of 100 = 0.78125  
 8.  $\frac{1}{256}$  of 100 = 0.390625  
 9.  $\frac{1}{512}$  of 100 = 0.1953125  
 10.  $\frac{1}{1024}$  of 100 = 0.09765625  
 11.  $\frac{1}{2048}$  of 100 = 0.048828125  
 12.  $\frac{1}{4096}$  of 100 = 0.0244140625  
 13.  $\frac{1}{8192}$  of 100 = 0.01220703125  
 14.  $\frac{1}{16384}$  of 100 = 0.006103515625  
 15.  $\frac{1}{32768}$  of 100 = 0.0030517578125  
 16.  $\frac{1}{65536}$  of 100 = 0.00152587890625  
 17.  $\frac{1}{131072}$  of 100 = 0.000762939453125  
 18.  $\frac{1}{262144}$  of 100 = 0.0003814697265625  
 19.  $\frac{1}{524288}$  of 100 = 0.00019073486328125  
 20.  $\frac{1}{1048576}$  of 100 = 9.5367431640625e-05  
 21.  $\frac{1}{2097152}$  of 100 = 4.76837158203125e-05  
 22.  $\frac{1}{4194304}$  of 100 = 2.384185791015625e-05  
 23.  $\frac{1}{8388608}$  of 100 = 1.1920928955078125e-05  
 24.  $\frac{1}{16777216}$  of 100 = 5.9604644775390625e-06  
 25.  $\frac{1}{33554432}$  of 100 = 2.98023223876953125e-06  
 26.  $\frac{1}{67108864}$  of 100 = 1.4901161193847656e-06  
 27.  $\frac{1}{134217728}$  of 100 = 7.450580596923828e-07  
 28.  $\frac{1}{268435456}$  of 100 = 3.725290298461914e-07  
 29.  $\frac{1}{536870912}$  of 100 = 1.862645149230957e-07  
 30.  $\frac{1}{1073741824}$  of 100 = 9.313225746154785e-08  
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 35.  $\frac{1}{34359738368}$  of 100 = 2.91038304567337e-09  
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 40.  $\frac{1}{1099511627776}$  of 100 = 9.094947017729281e-11  
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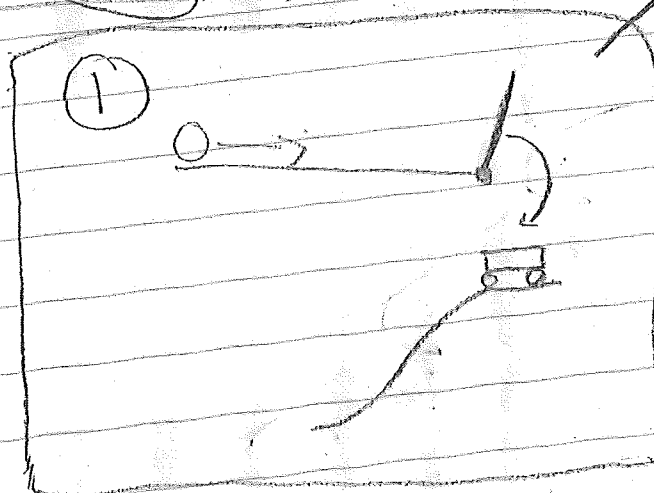
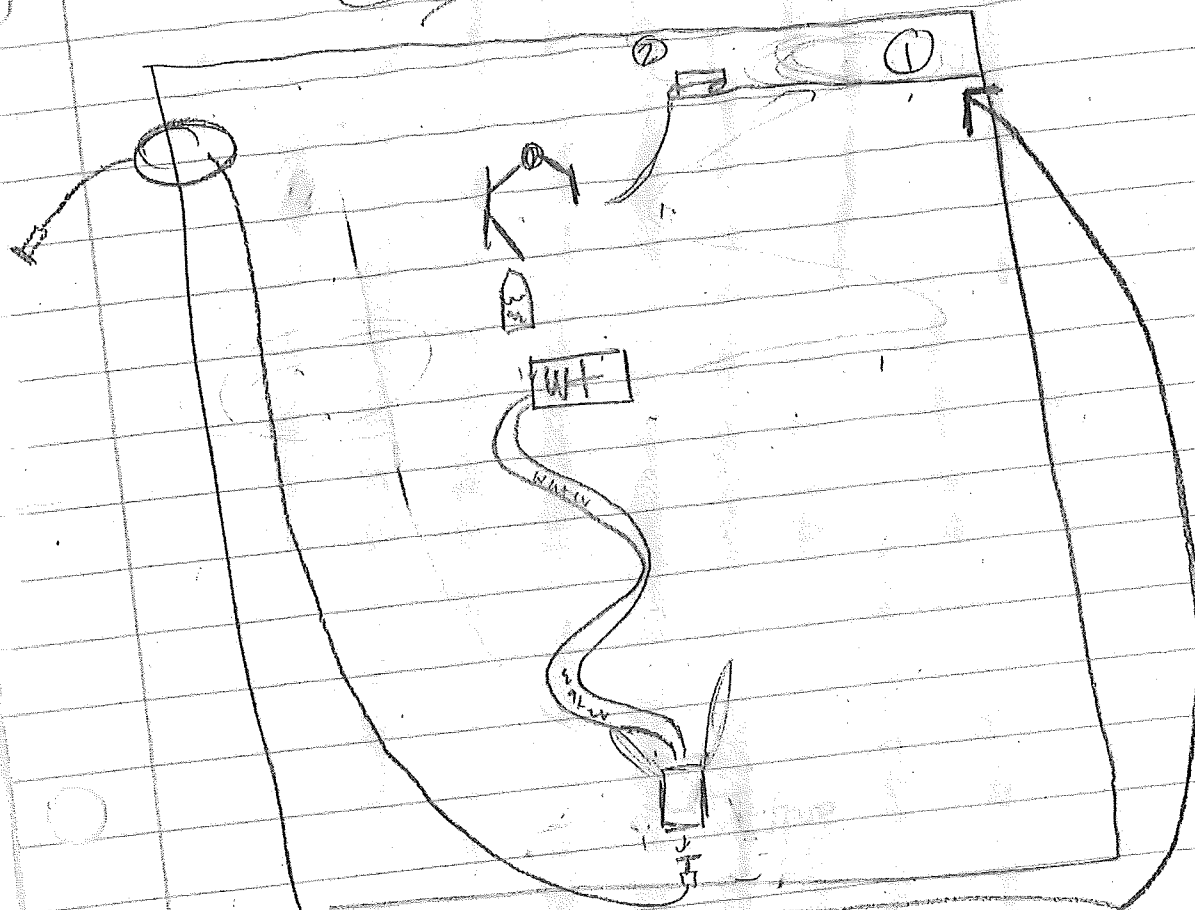
1.  $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$   
 2.  $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$   
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 4.  $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$   
 5.  $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$   
 6.  $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$   
 7.  $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$   
 8.  $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$   
 9.  $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$   
 10.  $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

~~what if we could turn  
this to a pendulum~~

①

Left

right  
PRESENT GROUP  
INITIAL DESIGN  
PLAN

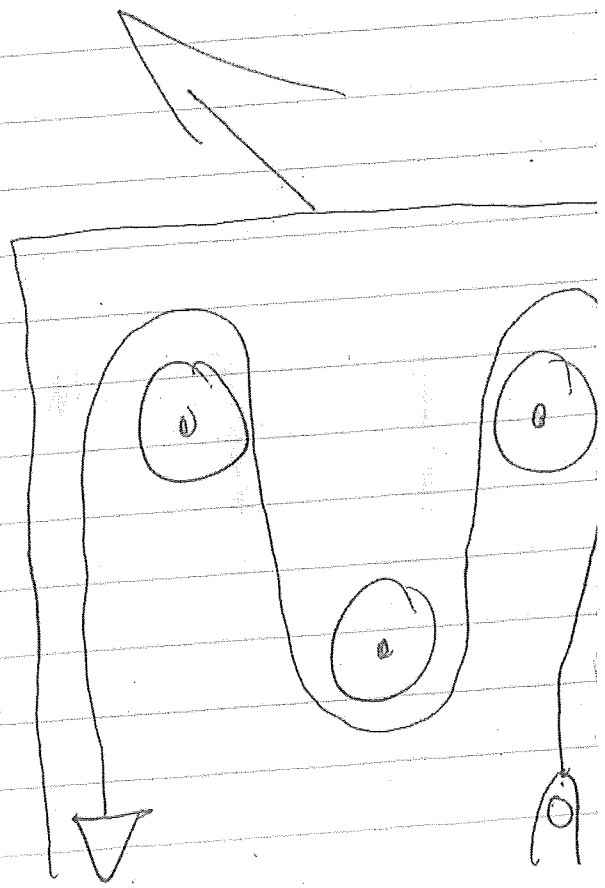
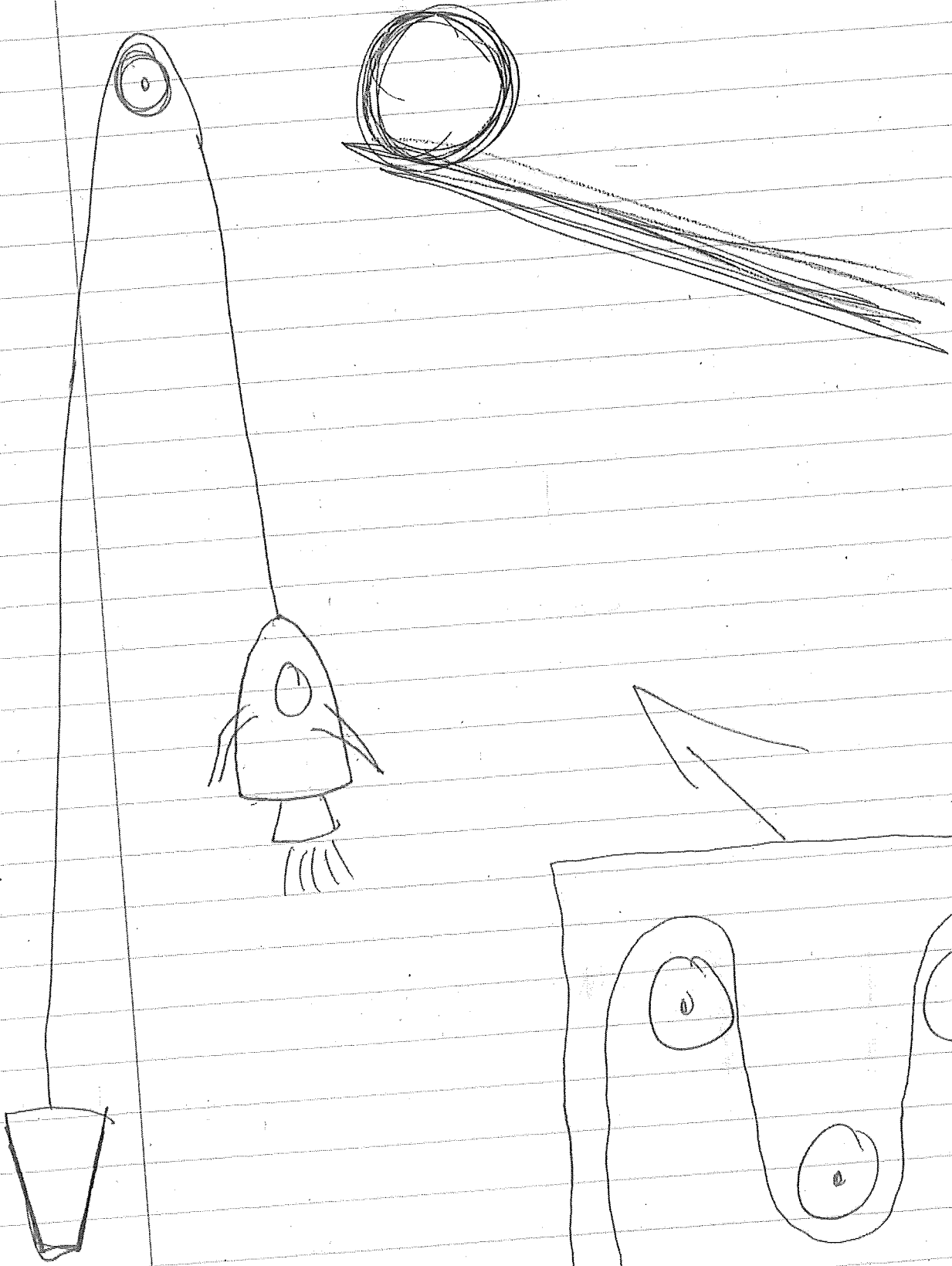


- dominos

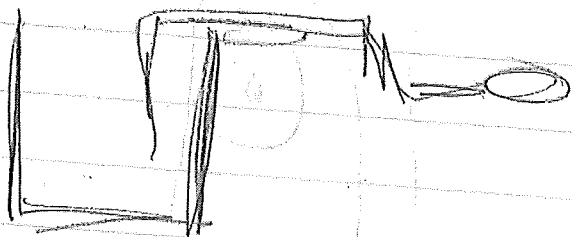
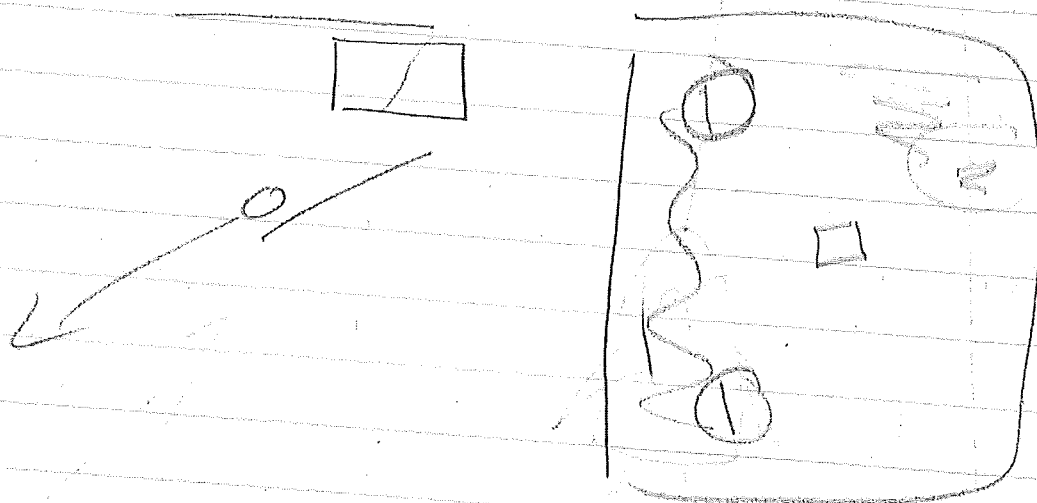
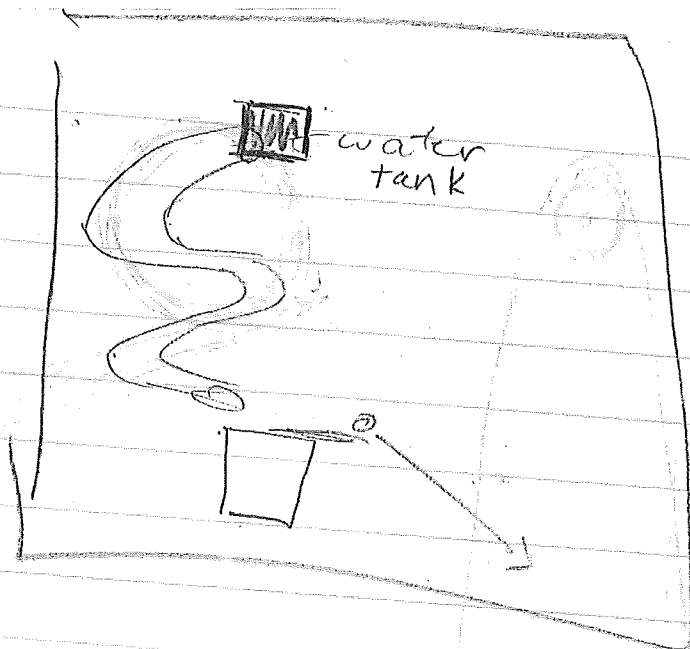
- car

Cup = looks like  
spaceship

2



②

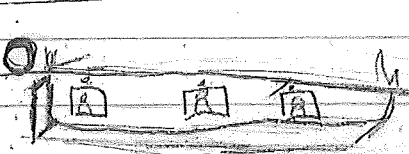


④

"Final"

Add  
step  
here

①



Box



②



③



water

water

④

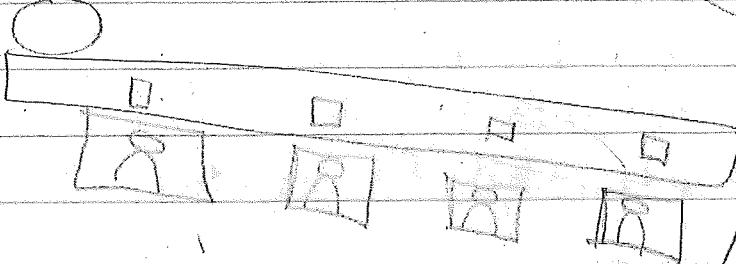
⑤



①



①





# lever system

String

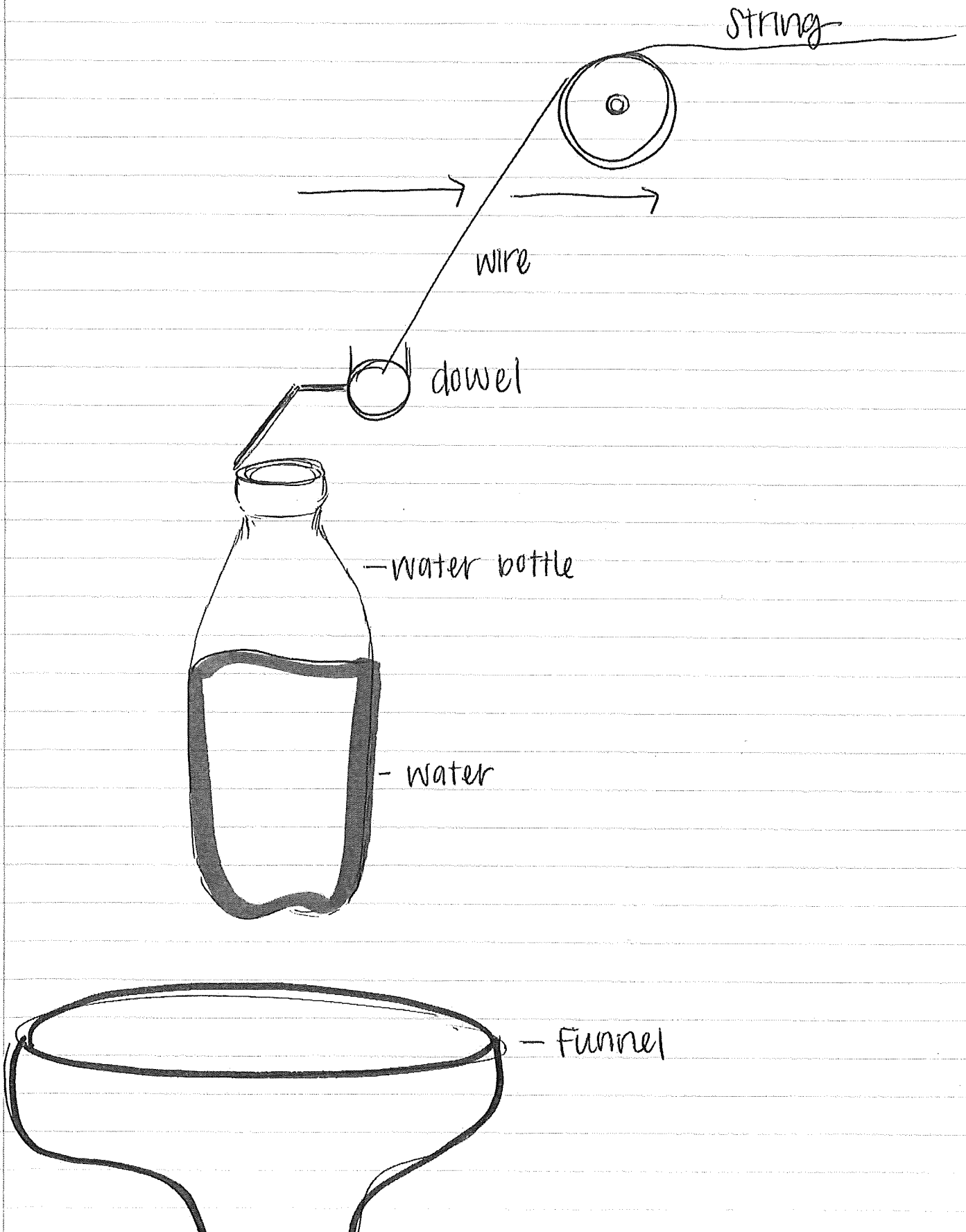
wire

dowel

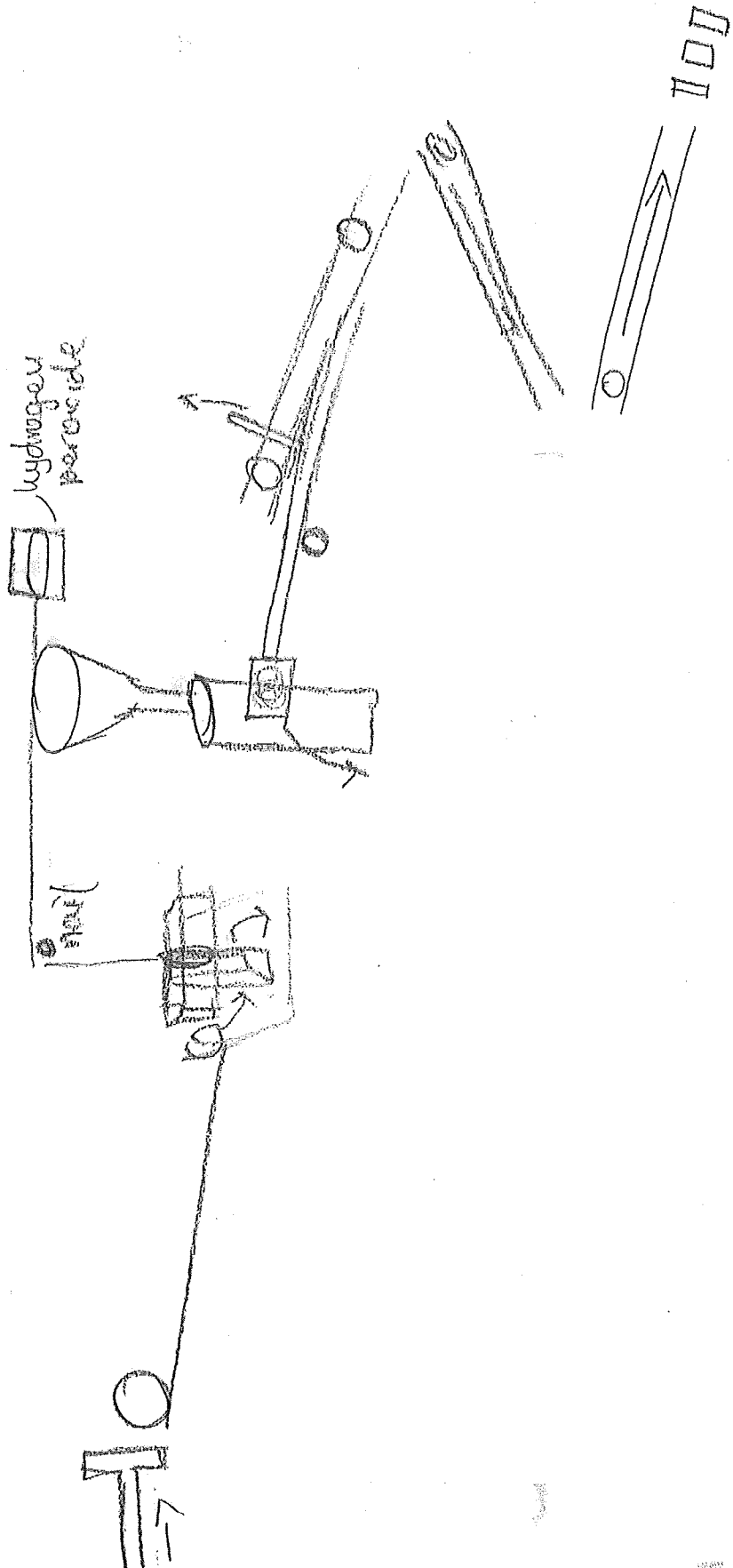
- water bottle

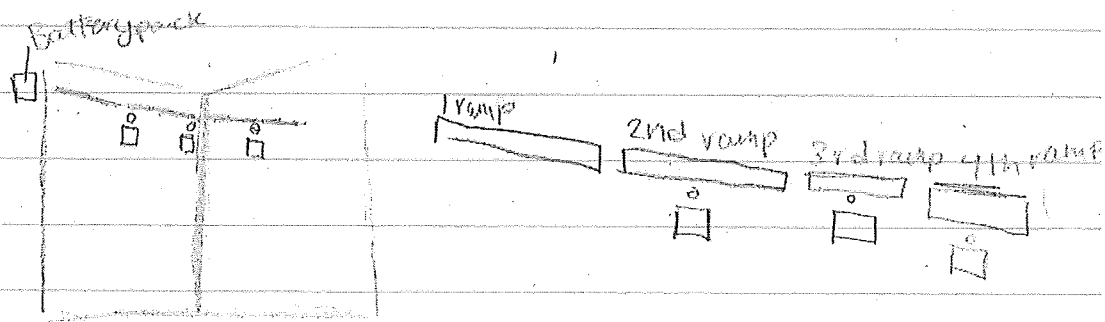
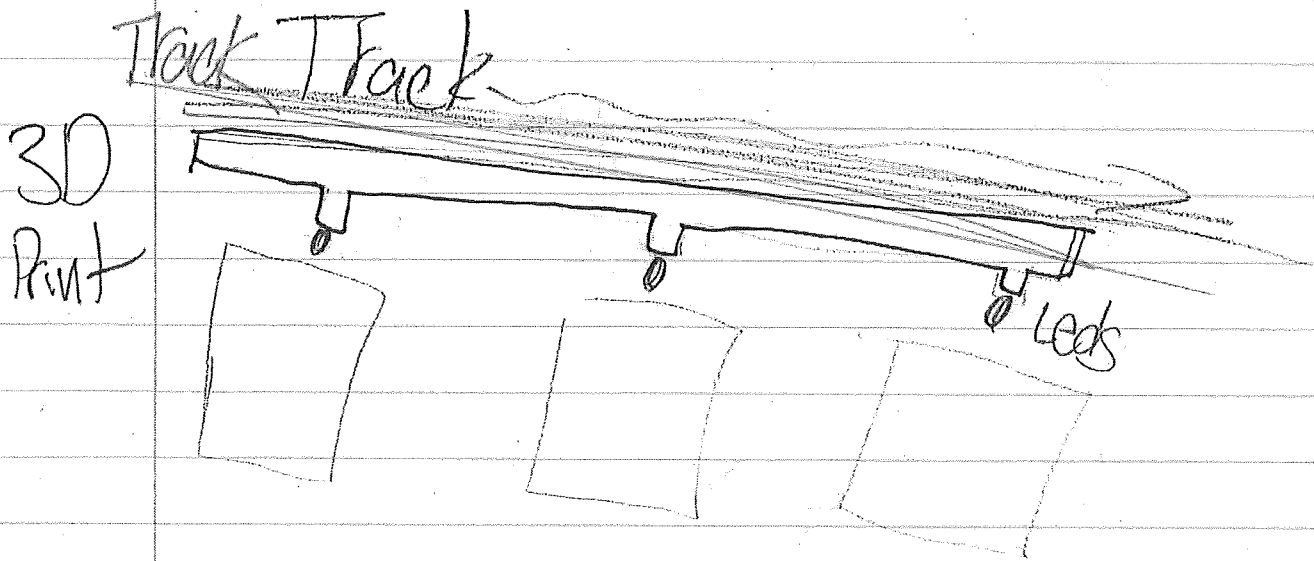
- water

- Funnel



# FUTURE INITIAL DESIGN PLAN



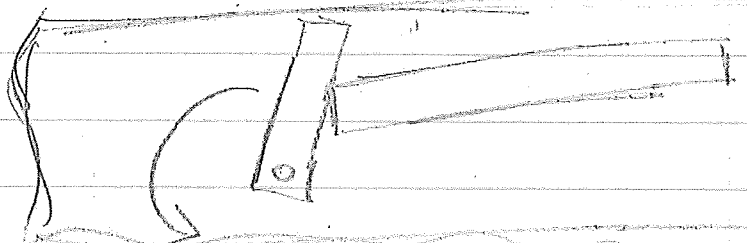


-input switch or button

\*-velcro for battery + LED

\*-use pictures to hide wiring

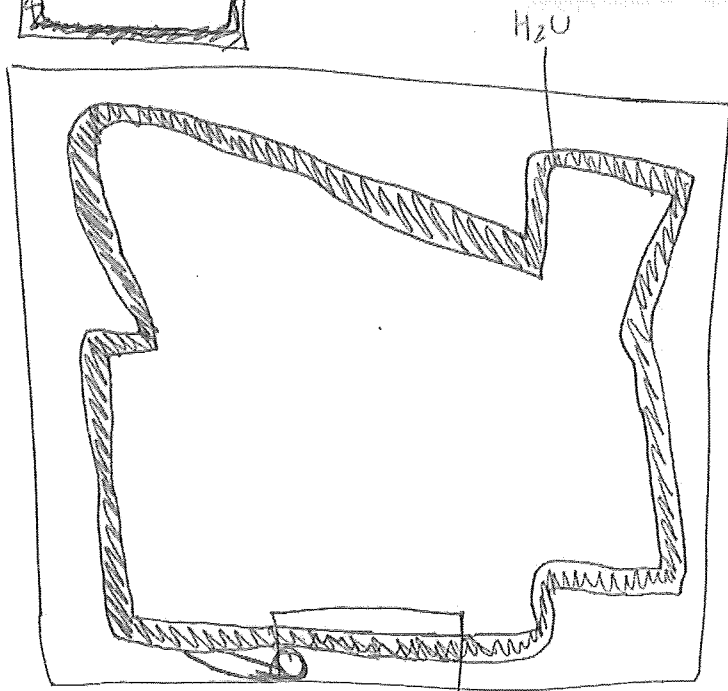
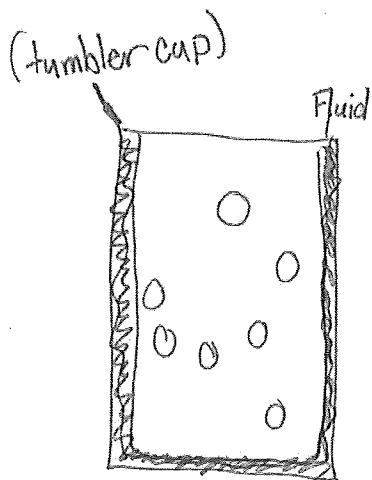
$$26 + 7 = 33$$



$8\frac{3}{4}$  roughly 4 ramps for 1st ramp

Balls ideas:-

BB - stars

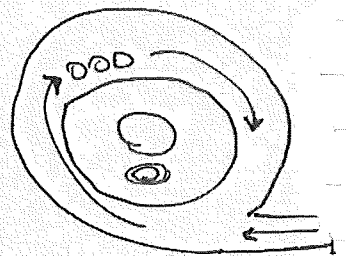
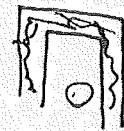


Fluid reaction

mineral oil doesn't  
conduct electricity the  
same way water  
does

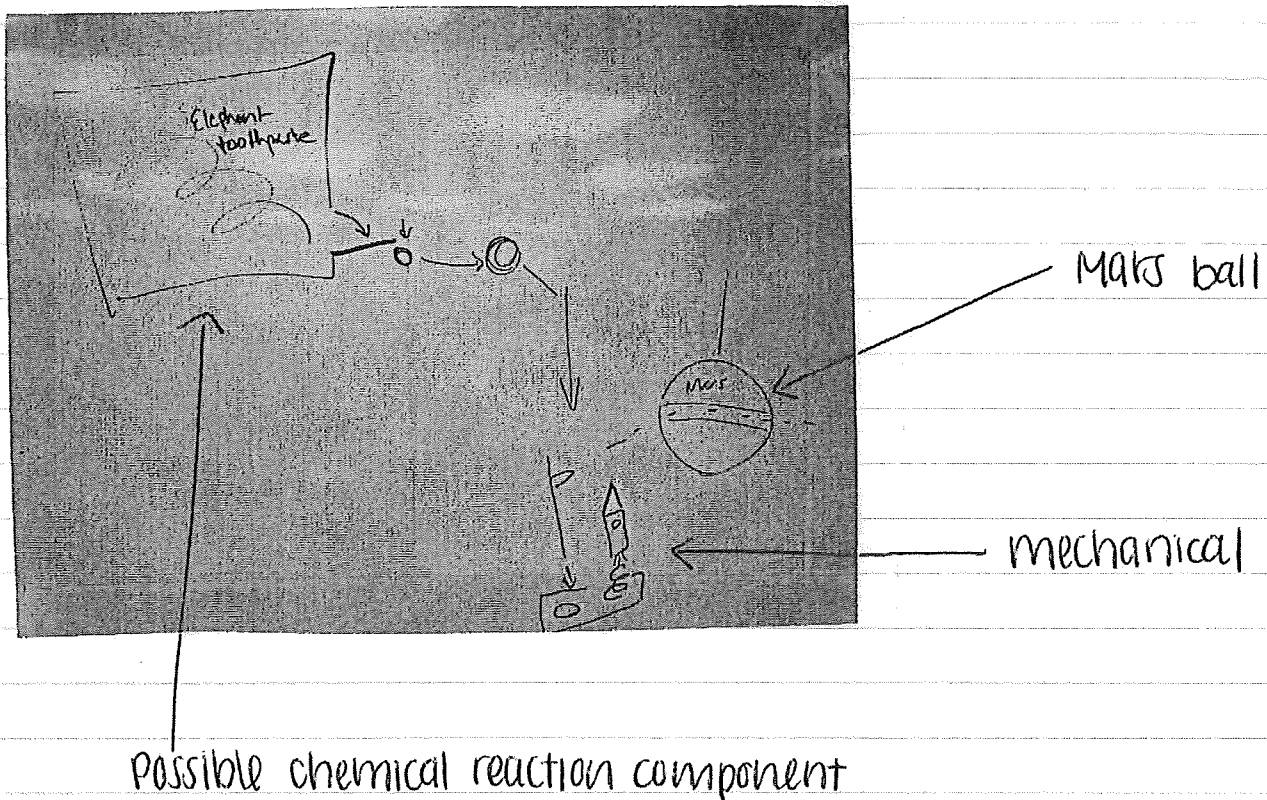
Fluid Reaction 2

Submerged electronics  
in mineral oil

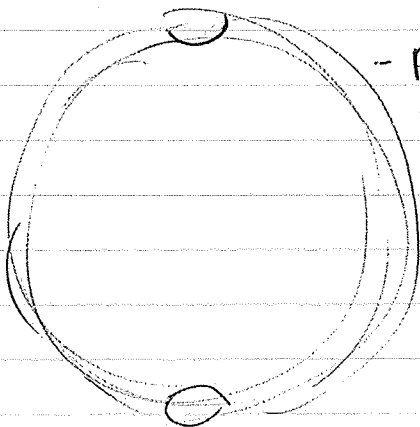


# Beginning the design process

Thursday, January 5th



Today we brainstormed ideas for our steps we came up with. This is a very rough draft but contains the basic design concepts

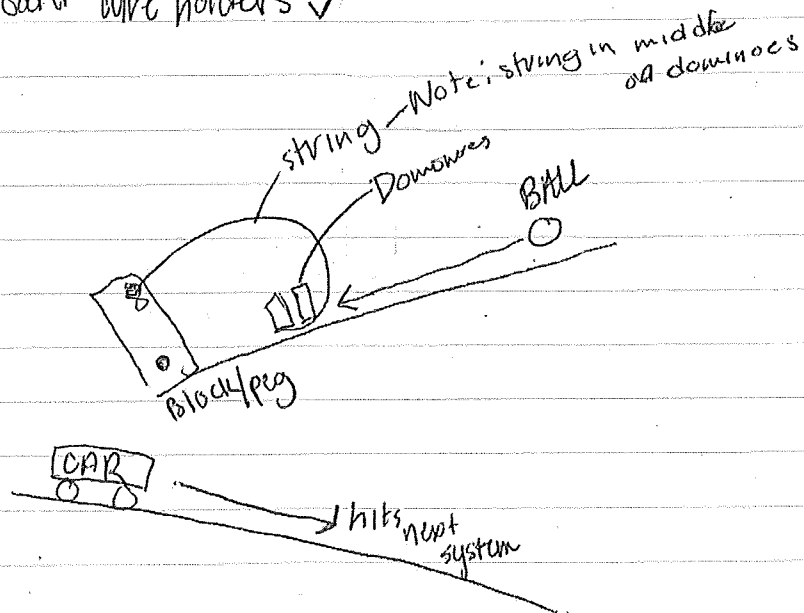


# Problem solving

Lights

- create cardboard wire holders ✓

Block + Car



Ramp. Bent steel/metal

Mechanics

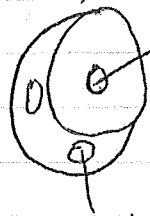
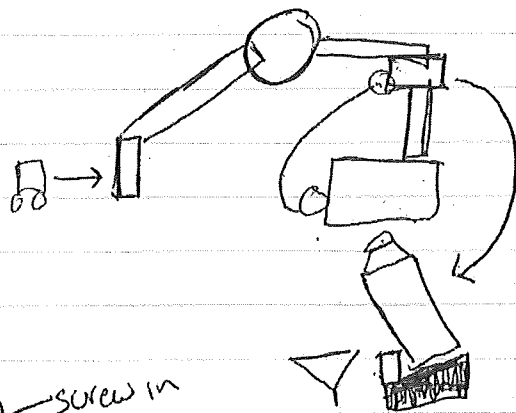


short dowel

long dowel

medium dowel

bolt



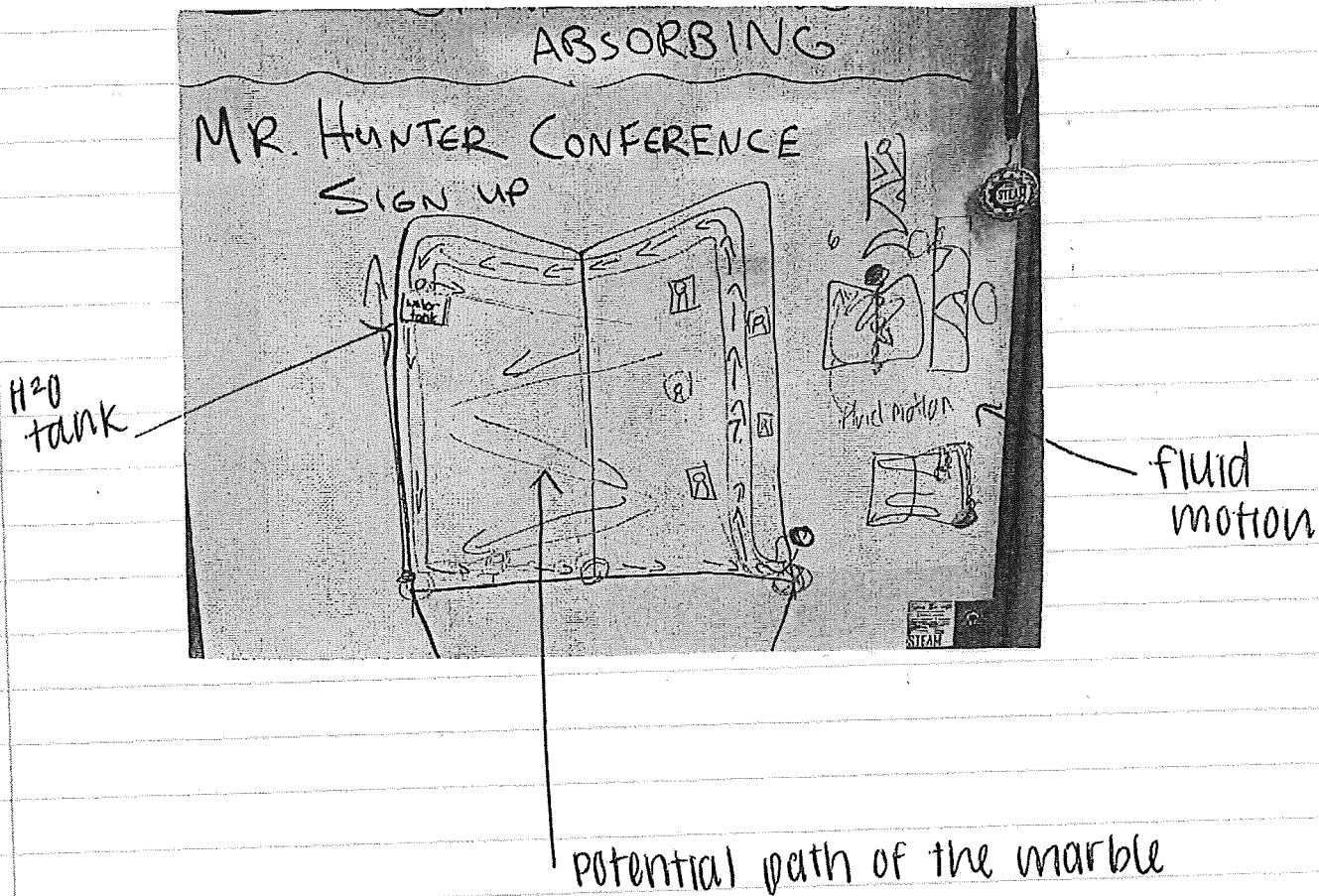
screw in middle - needs to be loose to spin

drill holes on sides to allow dowels into wood

Thursday, January 12<sup>th</sup>

Today we decided to have a conference with Mr. Hunter about our design process. We went through the required components such as mechanical, chemical, liquid, electrical etc. Overall developing a better understanding of our project requirements.

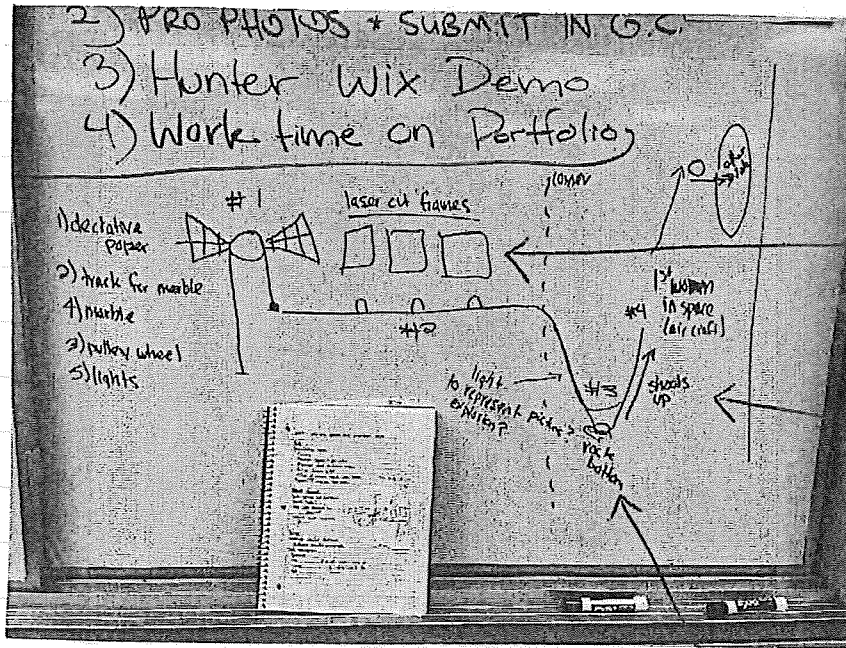
### Design for liquid component (initial)



— fluid component focuses (encased fluid movement)

Monday, January 16th

1. submit updates to project groupchat
2. work on demo with Hunter
3. work time on design process



lazer cutting skills learned!

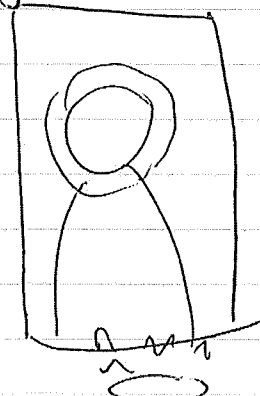
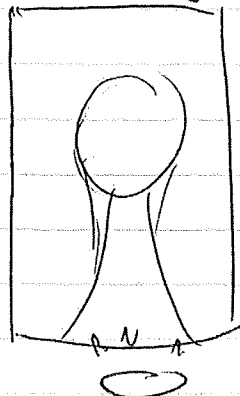
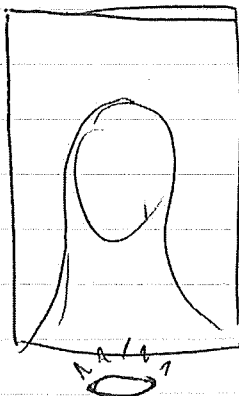
Force Required

possible materials list:

- 1) decorative paper
- 2) track for marble
- 3) pulley-wheel
- 4) lights (LED's)

Represents low point in women's space travel history.

illuminating photographs

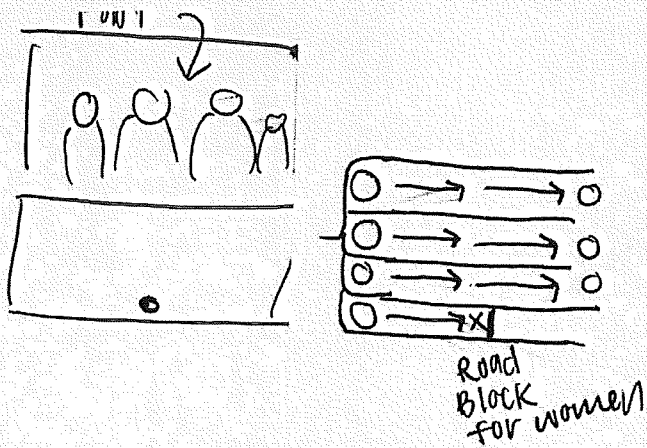




famous who  
lighting up  
3 illuminating  
(clear acrylic +  
LED)

Shoulders of  
Giants  
Women ↓

light up  
each event



Leaf  
Confetti  
celebration

Part:

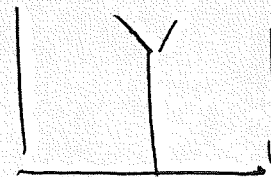
Continue the  
timeline

- Audios of  
famous women  
saying quot

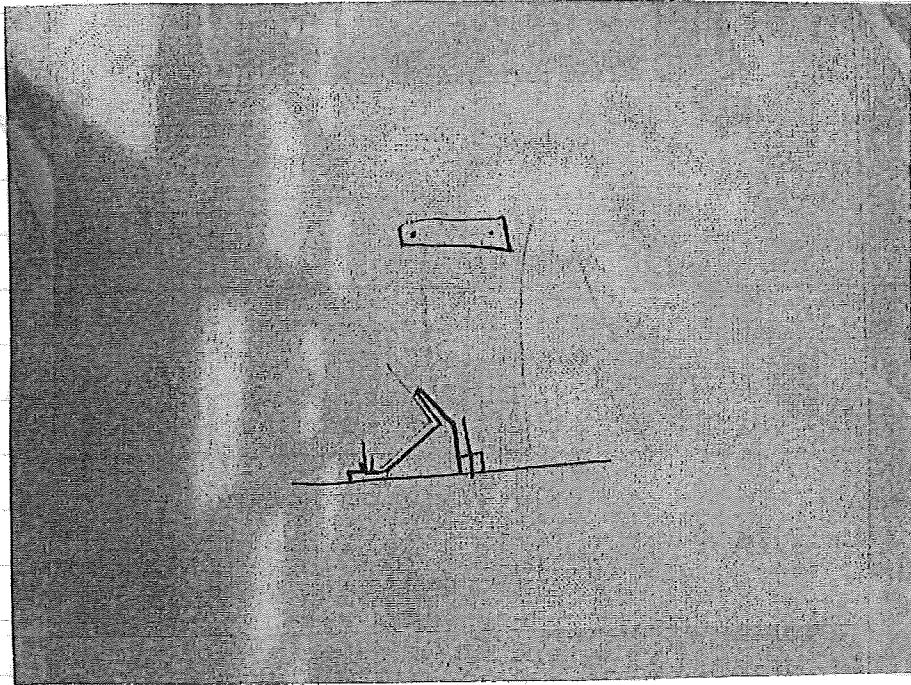
what things  
you through  
the timeline

- incorporating  
famous women

sta

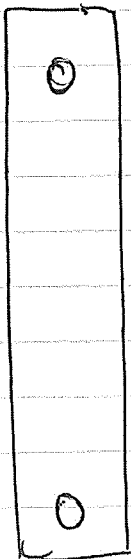


Friday, January 27<sup>th</sup>



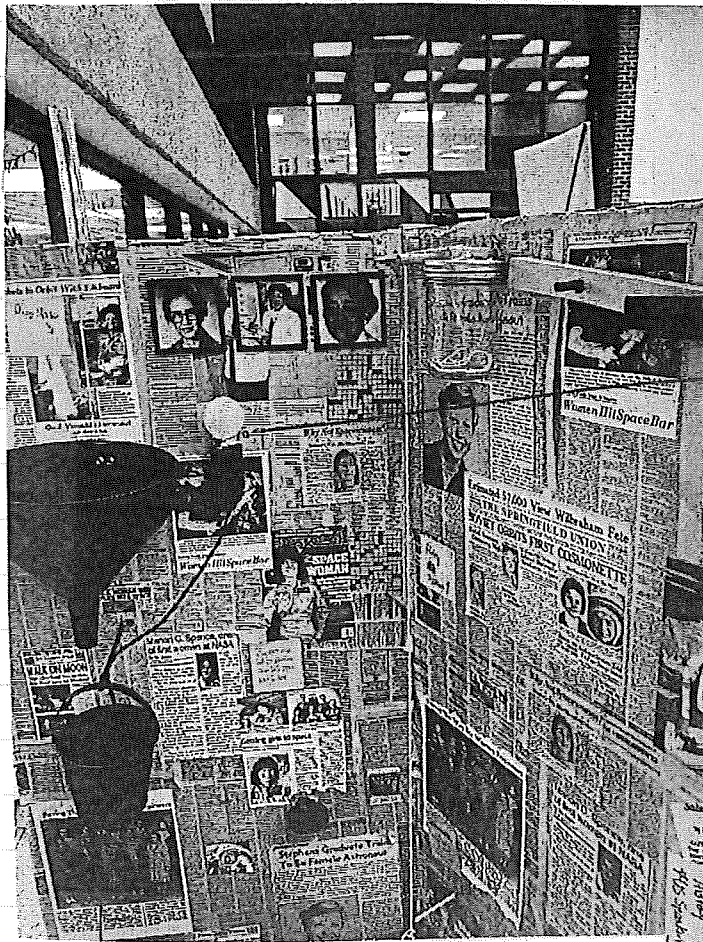
Today we looked  
at possible  
bracket designs  
to support the  
tracks.

possible bracket design



3D Printing  
Filament

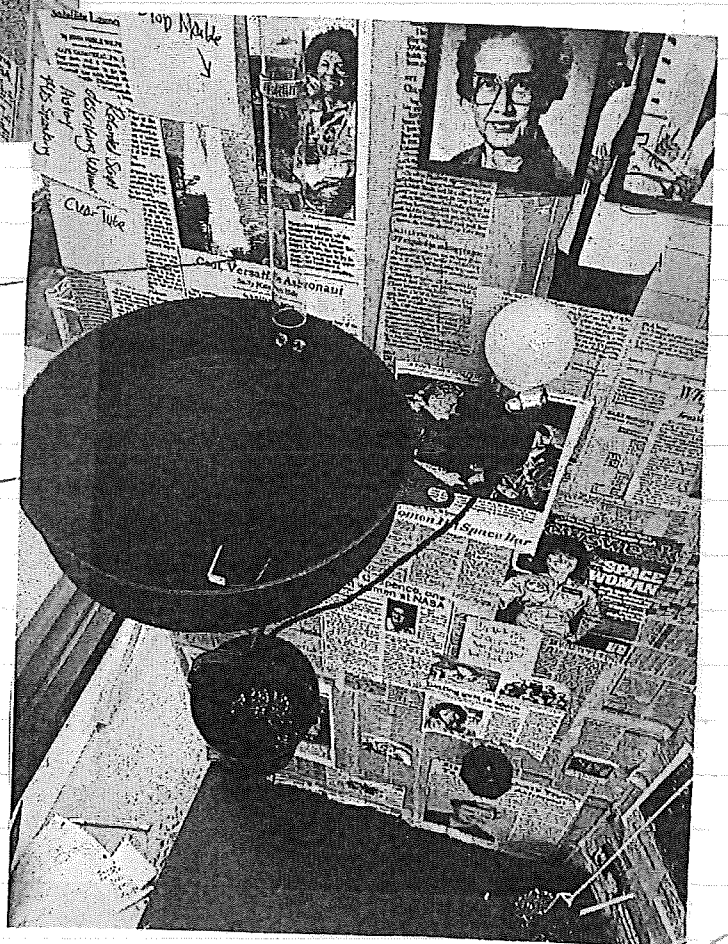
# Past group progress pictures



Electrical  
component

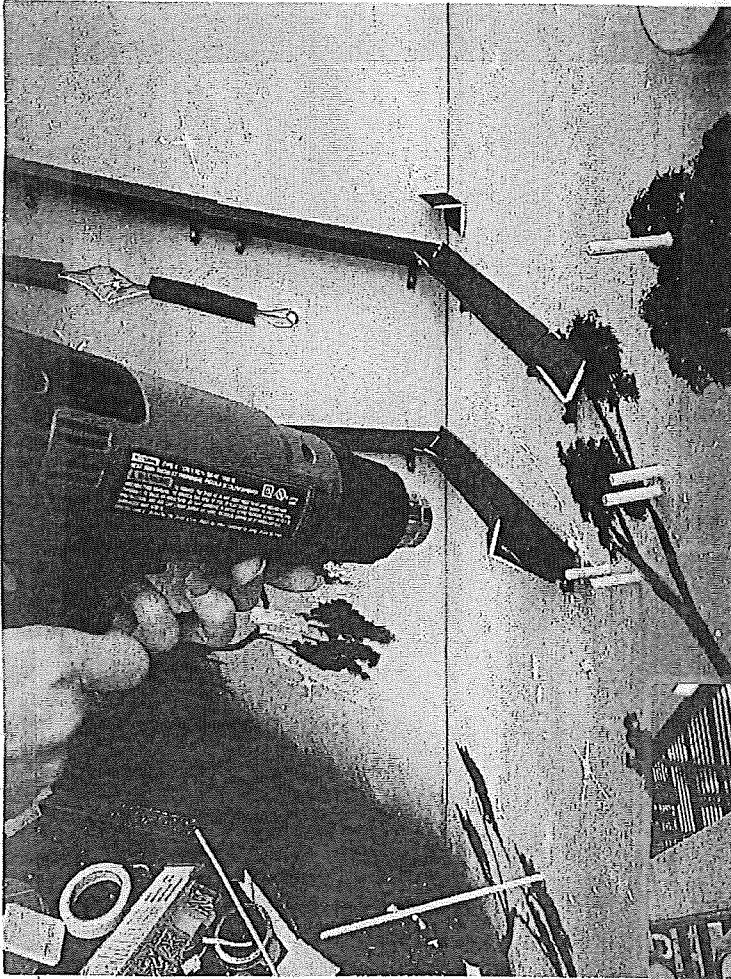
first step

Bucket  
for weight funnel





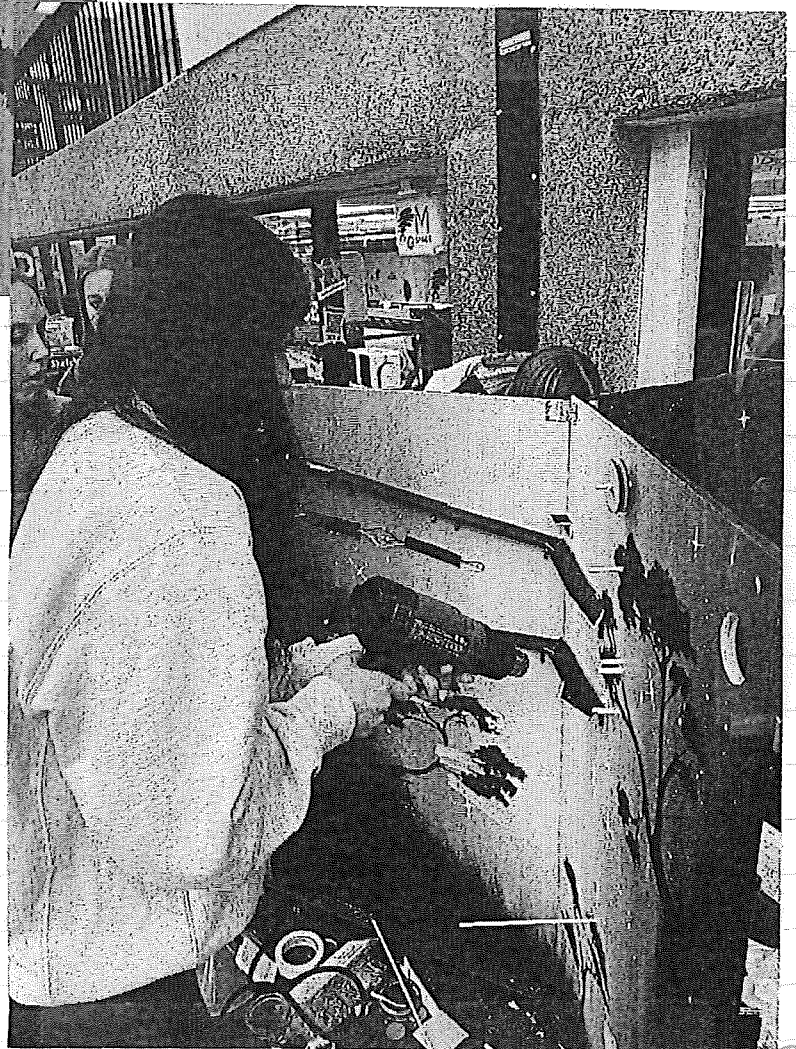
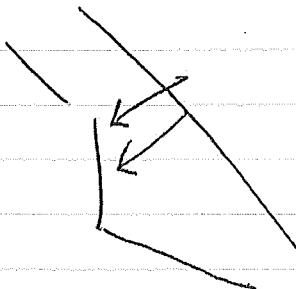
# Problem solving



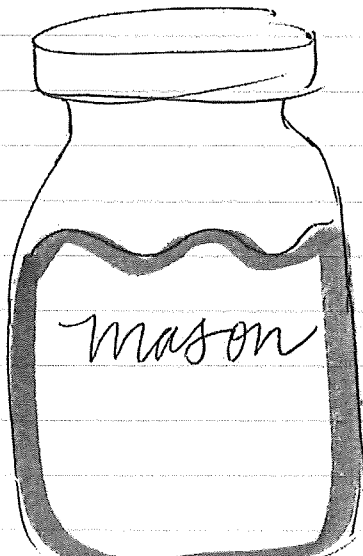
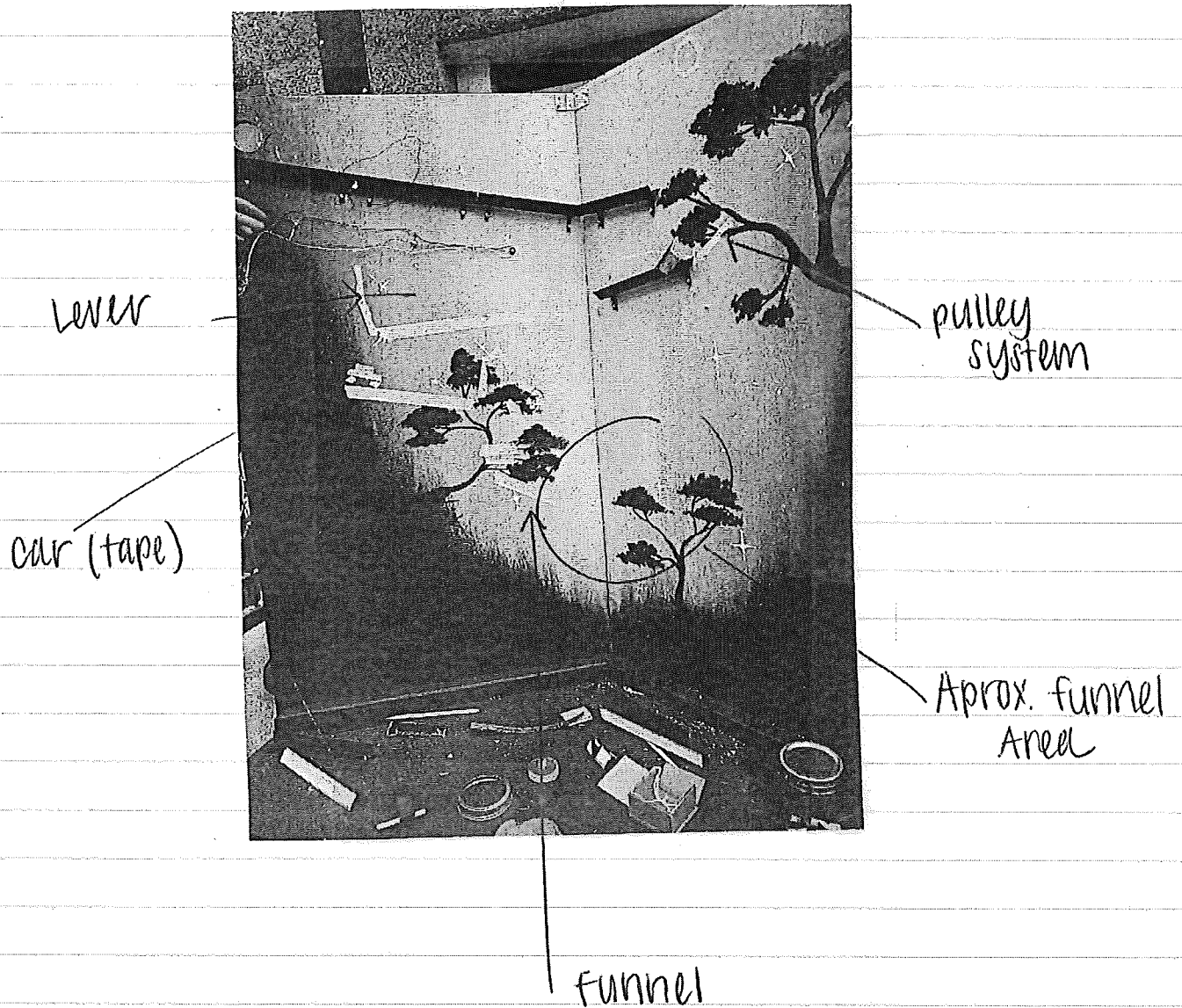
- pathway too narrow for ball to move through.

- instead of re-cutting a new piece & wasting material, we decided to test if a heat gun made plastic malleable.

- we heated the plastic and were able to form the plastic.

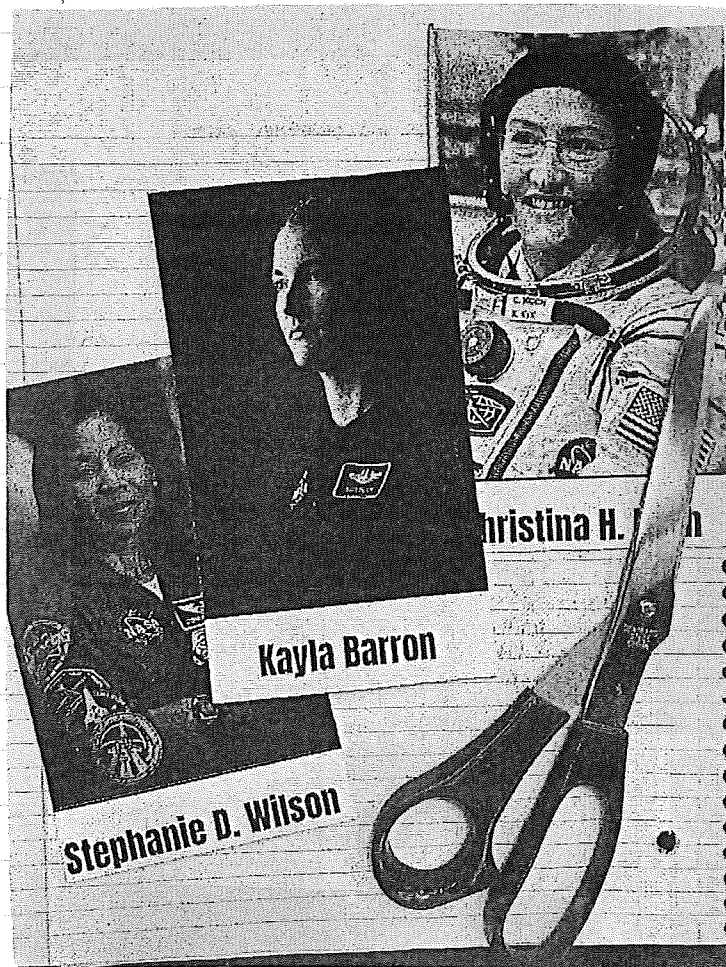


## Rough Mapping with tape



fill the water bottle

February 15th, Wednesday



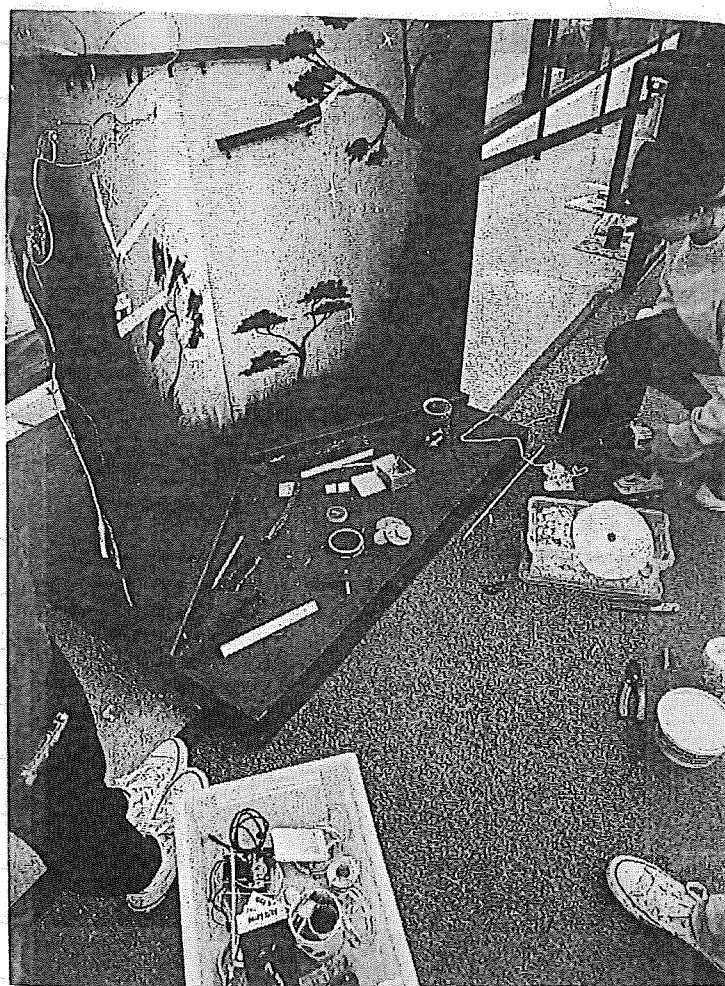
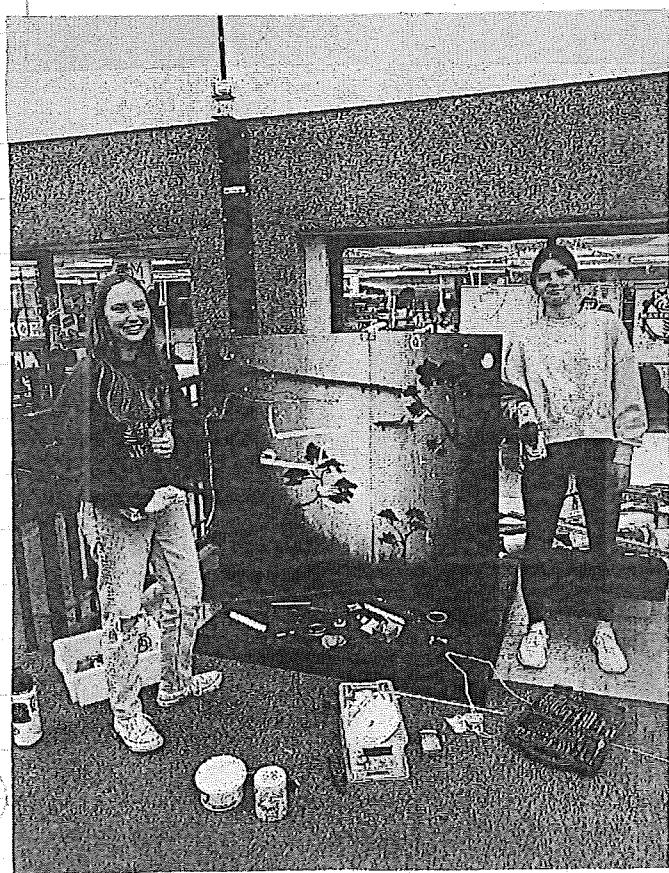
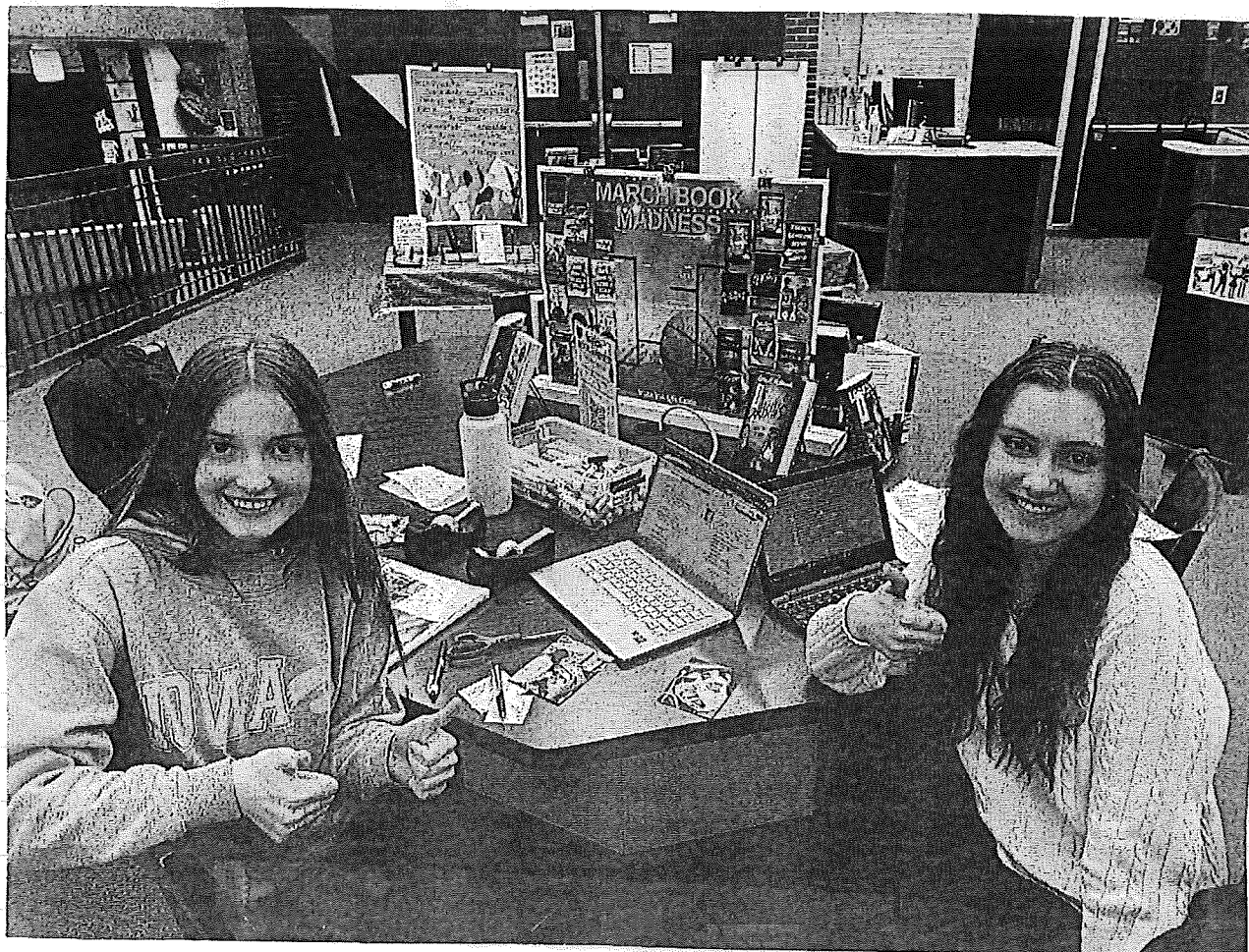
Today we decided on the 3 historic women we wanted to highlight in our present group.

Stephanie D. Wilson - American Engineer & NASA Astronaut. 3x space shuttle passenger.

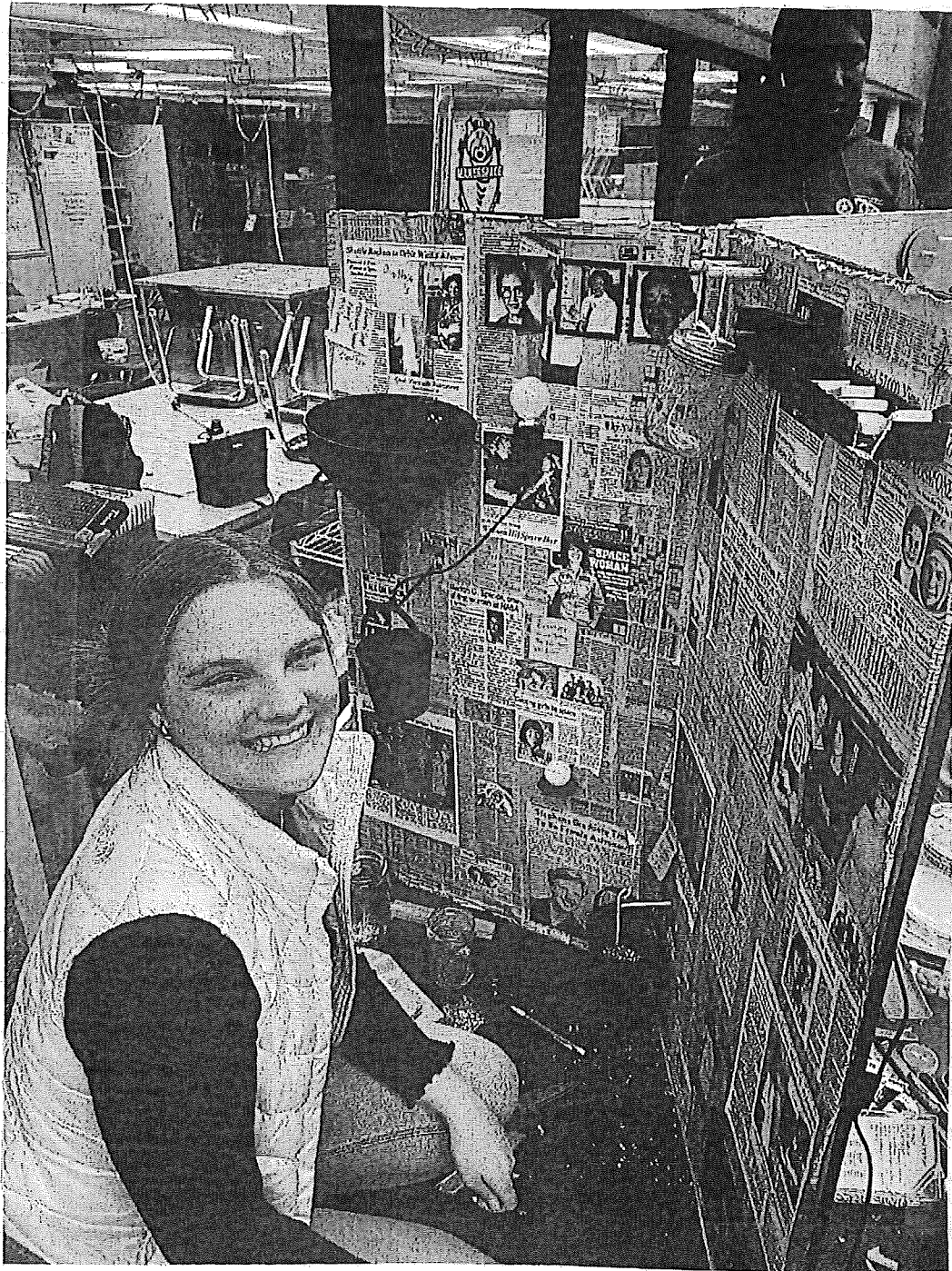
Kayla Barron : American Submarine Warfare officer, engineer, & NASA astronaut.

Christina H. Koch: Engineer, NASA astronaut, and flight engineer on the International space station

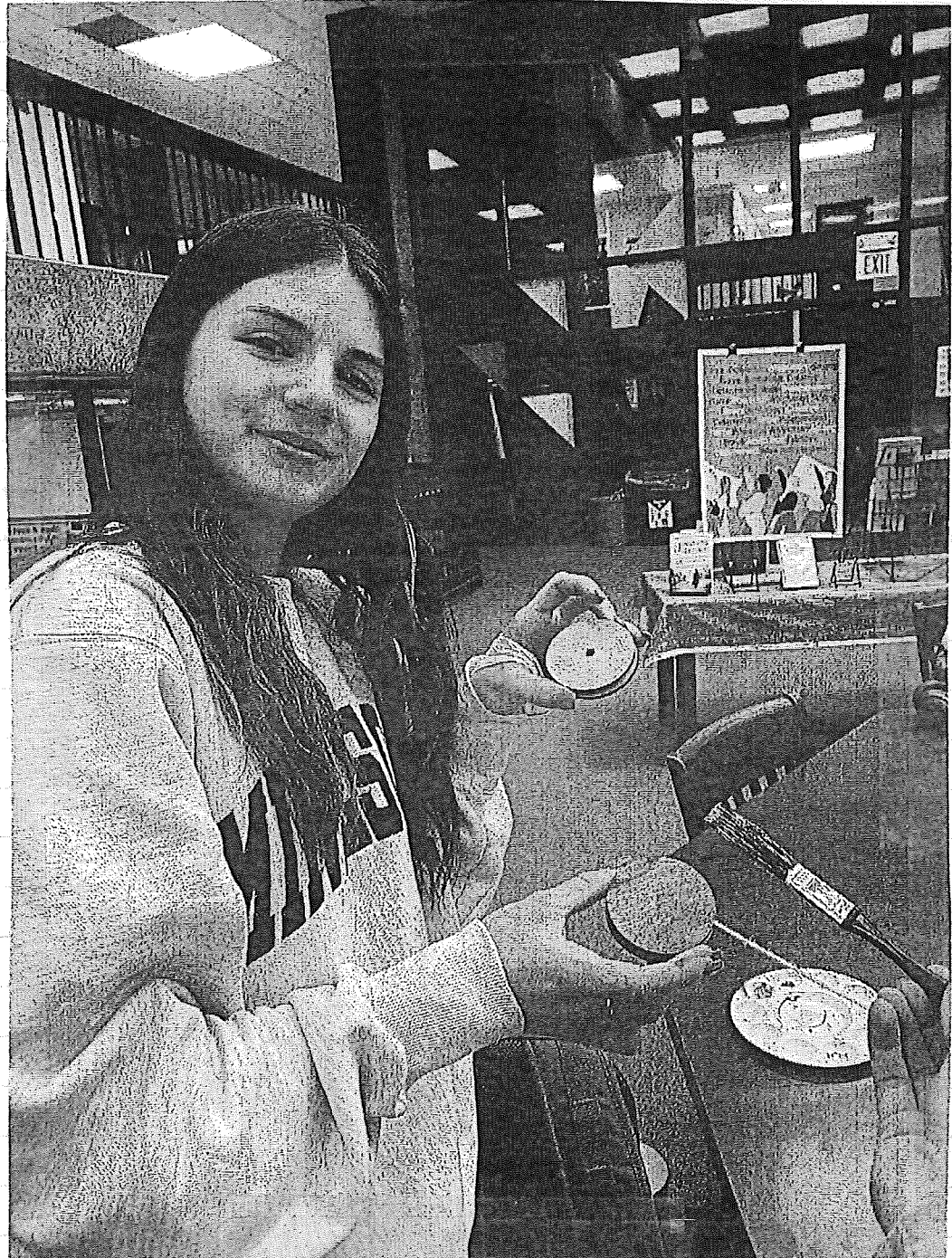




# ~~Editing~~ process







# Final Machine Design Drawing/Image and Description

11/22 - 11/25 project worktime

★Paint base and background of boards/structure★

Past

Present

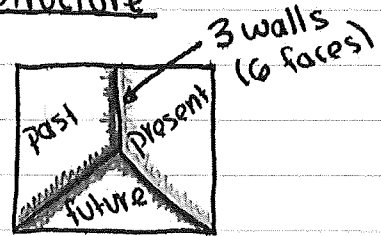
Future

historic newspapers → landscape on earth → futuristic black hole  
Past: looking @ sky/space in space



real newspaper  
clippings related  
to women in space

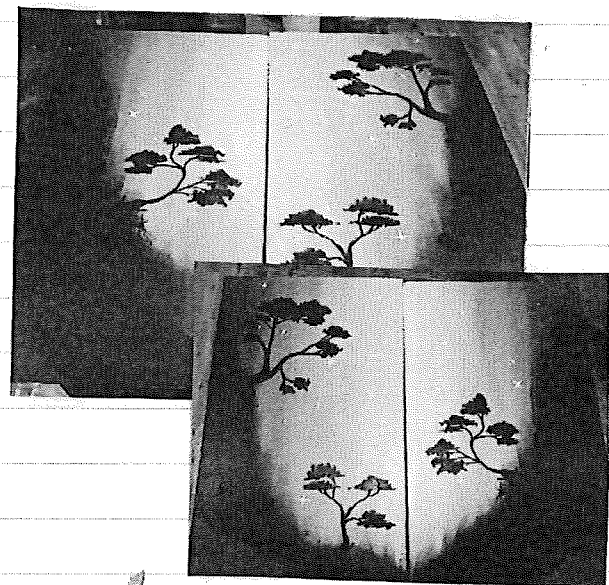
Structure:



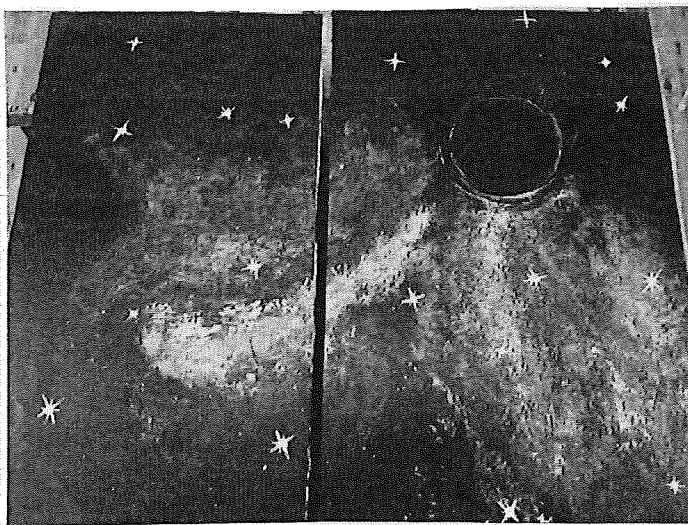
base



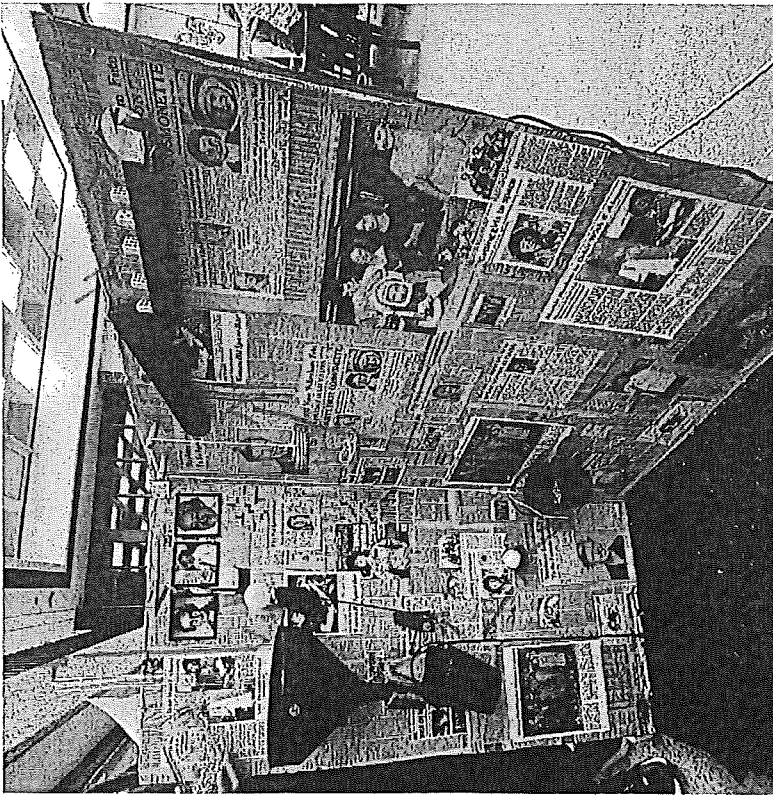
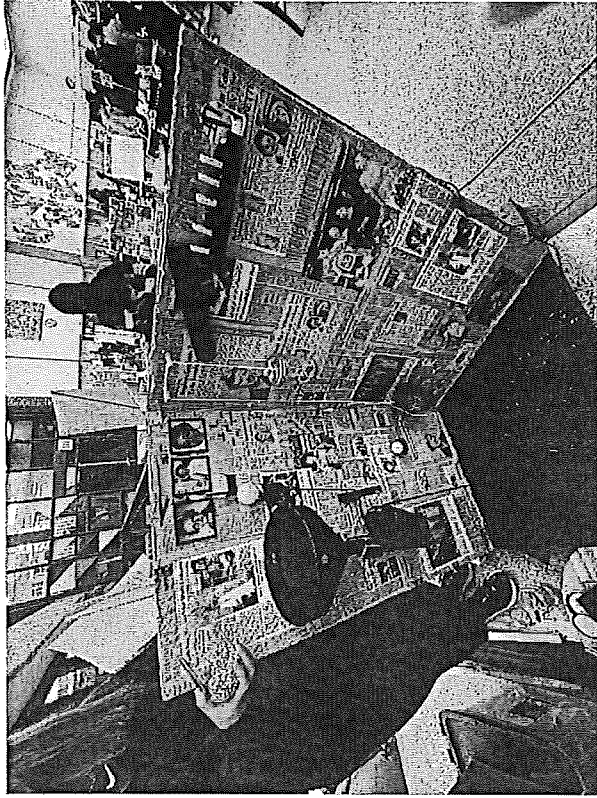
Present:



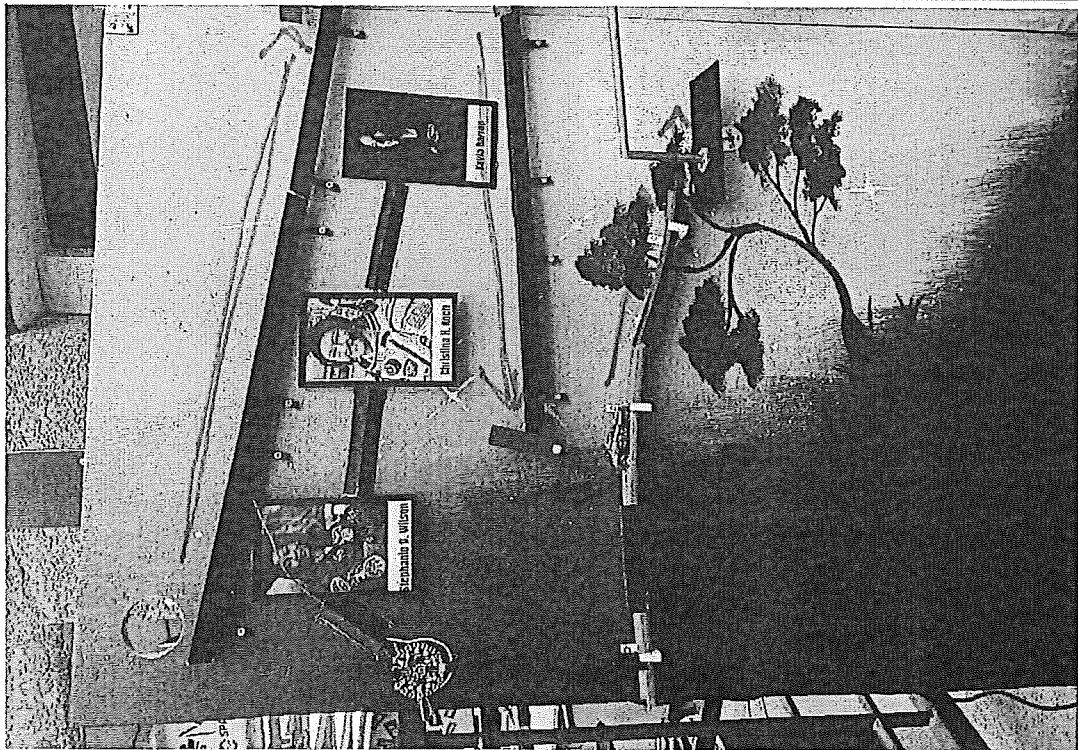
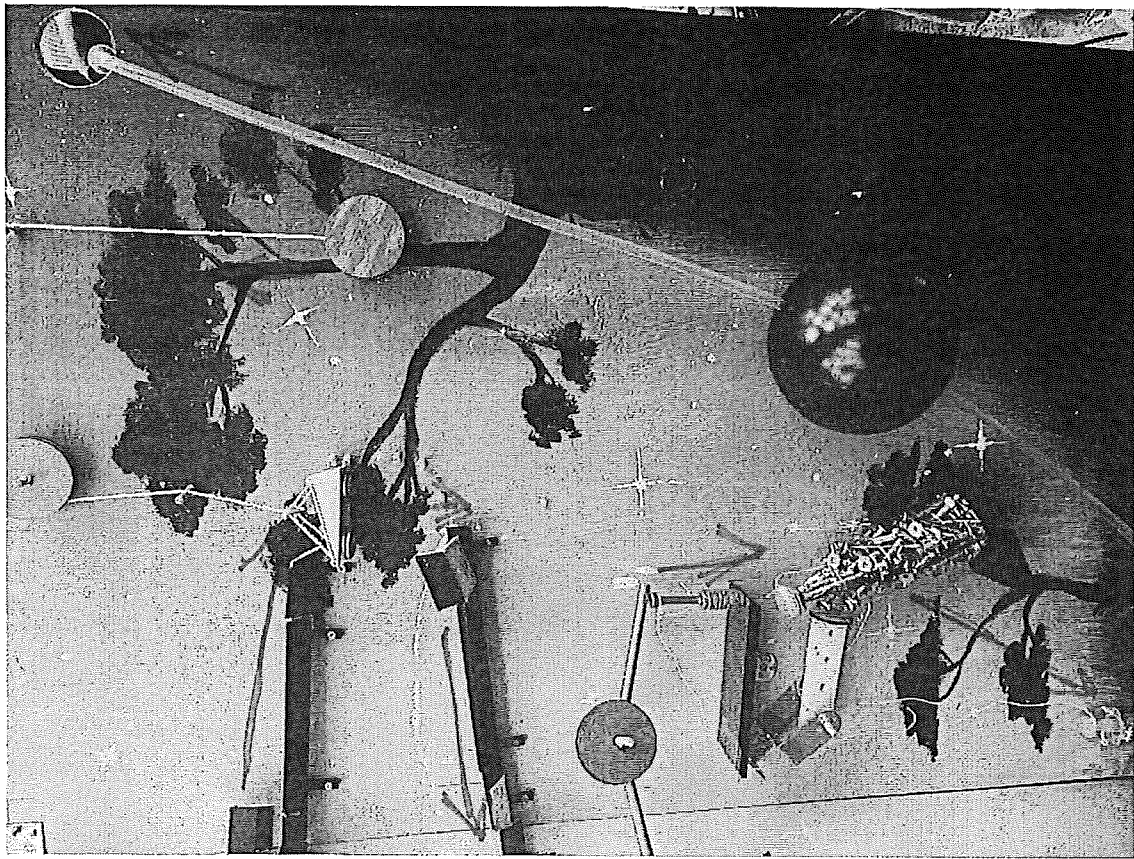
Future:



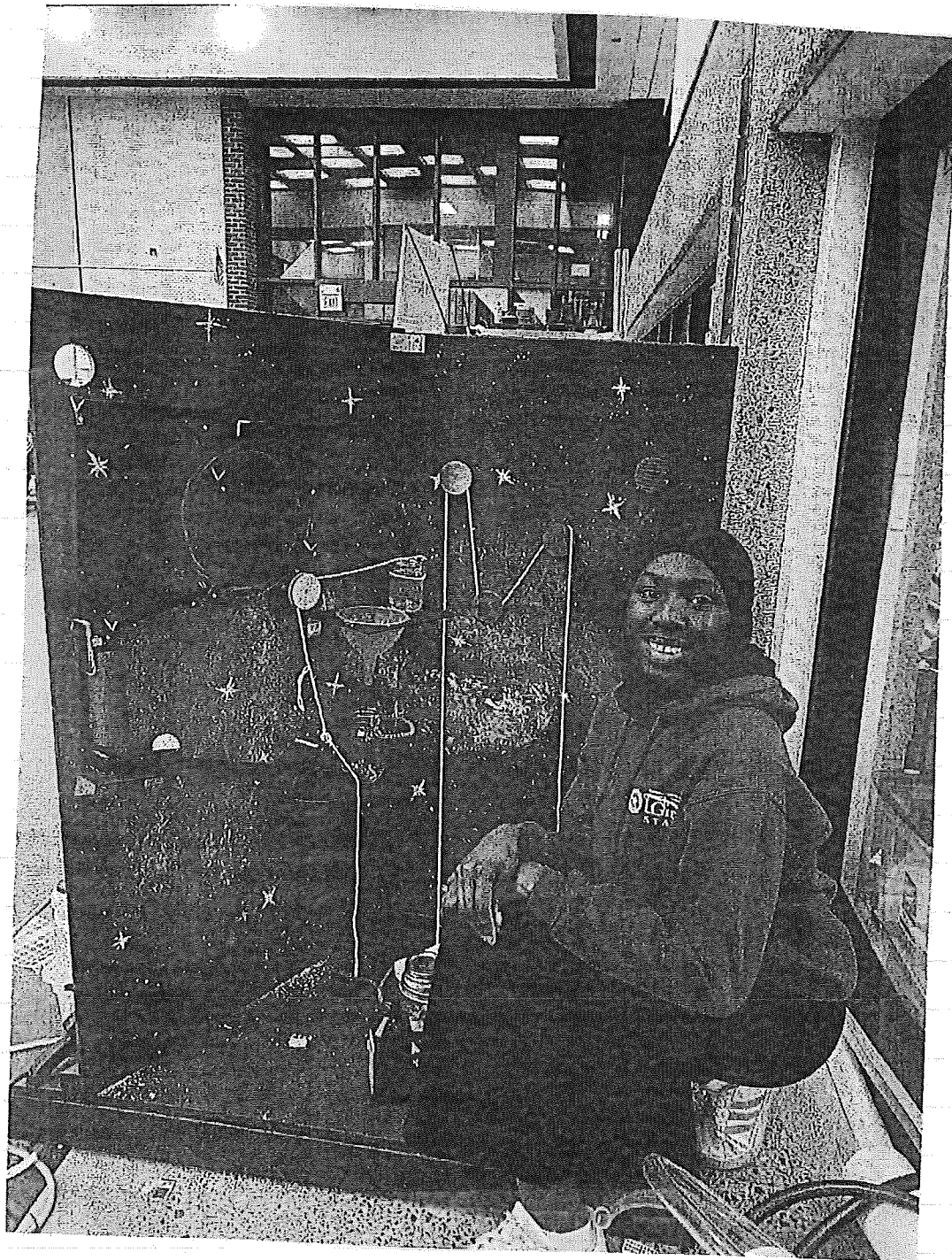
landscape w/ the night sky  
to symbolize the present  
-ground & trees pull the  
futuristic black hole viewers to earth  
design to symbolize the  
continuous improvement  
and development regarding space







**STEPS:**





12/11 & 12/18 : assembling boards

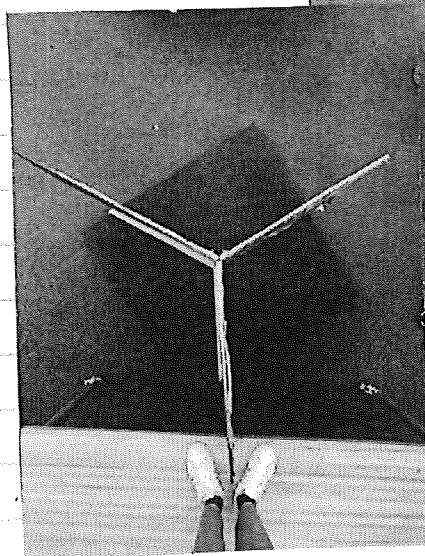


- paint base black
- assemble finished boards to base
- add metal support beams ~~to base of walls~~ to top corners of walls (where they connect)
- add wooden support beams to bottom of walls

↑  
attaching wooden support beam



bird's eye view →  
view of project structure



↑  
circled metal support "clasps" or parts that connect top of wall boards in the center

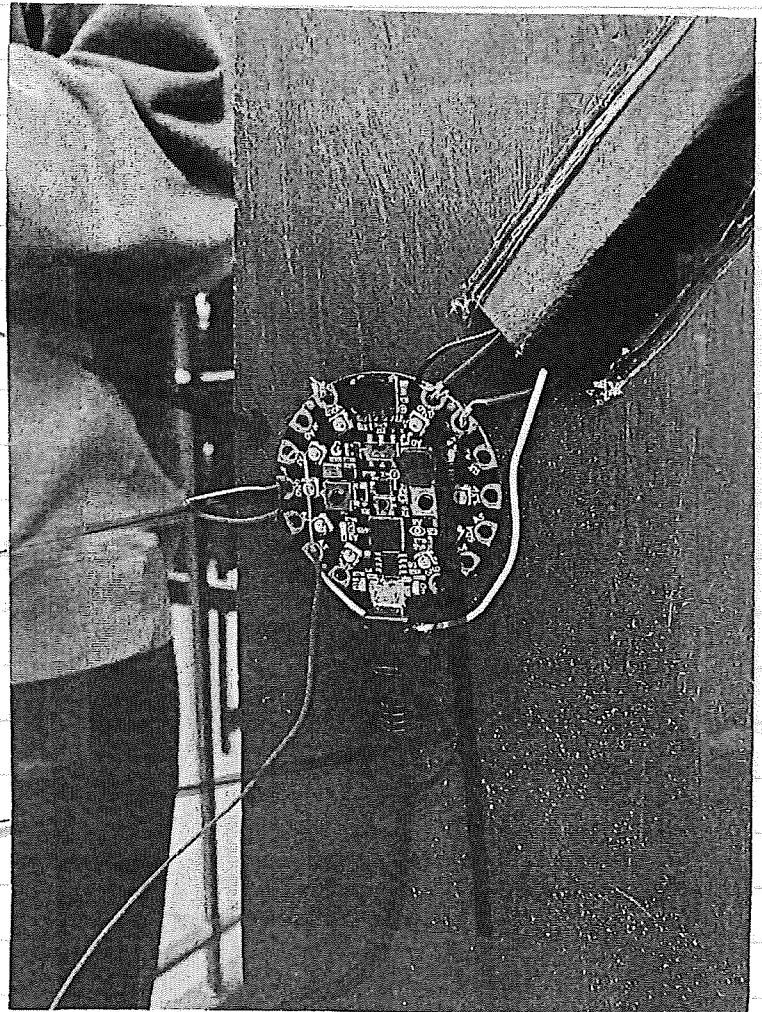
February 10th, Friday

Present group

Microbit plate

GND connection

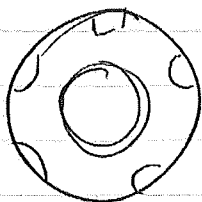
USB power  
connection



We soldered & connected  
our circuits to have a light-up  
aspect in our board.

A7 connection

GND connection

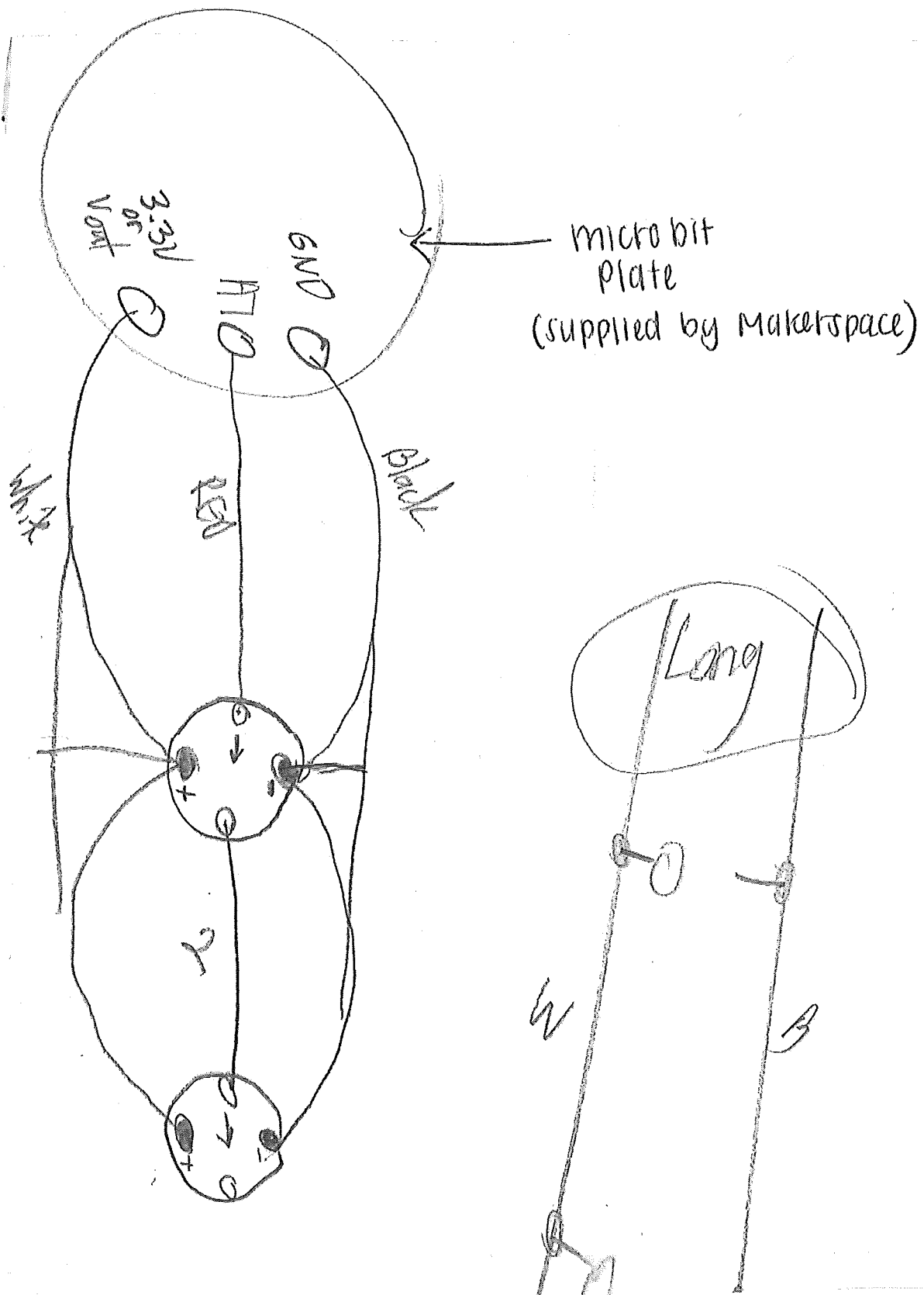


— high definition  
LED



✓

circuitry design component:



# Lists of Machine Steps

# Steps for 2/4

## Step 1)

- figure out where group before ends ✓
- drill holes ✓
- create start of truck

## Step 3)

- create pulley system
- create 3D box (light weight) (maybe cardboard?)

## Step 2)

- Print out pictures
- code 3 LED'S ✓
- figure motion sensor
- Attach LED, Pictures, Wires, and motion sensor

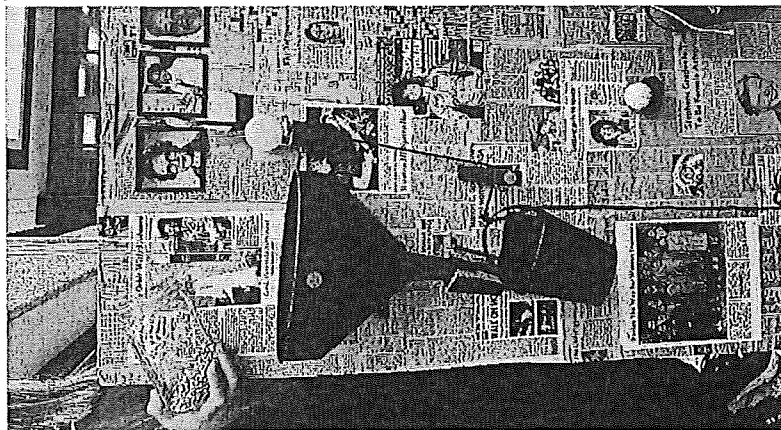
## Step 4)

- figure out hinge paddle thingy ✓
- angle of ramp + ramp

## Step 5)

- figure out paddle hitting car
- create ramp

## "PAST" GROUP'S STEPS



### STEPS:

1. Person will pour a jar of screws into the funnel, which will then fall into the bucket. This additional weight will cause the bucket to fall.
2. The added weight will cause the bucket to fall triggering the lightbulb to turn on as well as swing over to hit the golf ball.
3. The golf ball will then be knocked into the 2nd bucket triggering the pulley system.
4. The additional weight on the bucket will disproportionate the pulley system and cause the bucket to fall while the mason jar on the opposite side goes up.
5. The jar will then rise up to hit the wooden lever and push the left side up.
6. Lastly, the right side of the lever will push down on one dominoes, causing the other 4 dominoes to fall in a chain reaction to finally hit the black ball into the next section of the rube goldberg.

## "PRESENT" GROUPS STEPS

1. Ball rolls down the track (triggering our electrical circuit along the way) and falls down into the white pulley basket, lowering the pulley to the next track, then the ball keeps rolling until it hits a bar at the end of the track.
2. The bar moves, pushing the Hotwheels car down the track.
3. The car hits a wooden dowel that is supporting a pulley system.
4. The pulley system becomes unbalanced, and the right side moves down.
5. The right side of the pulley hits a water bottle full of bolts, causing it to fall.
6. The water bottle falls on the syringe, pushing the syringe down on one side.
7. The water in the syringe gets pushed forward, pushing out the other side of the syringe.

## "FUTURE" GROUP'S STEPS

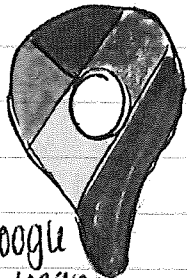
### STEPS:

1. The syringe pushes the black ball down the ramps and tubes.
2. The black ball pushes the golf ball down the ramp and into the bucket.
3. The bucket falls, triggering our chemical reaction above by pulling a glass jar down, which spills the chemicals into the funnel and down into another mason jar, causing the elephant toothpaste to foam up. It the bucket will also fall down moving the seesaw below.
4. Lastly, the seesaw hit a wooden block, which falls.
5. The momentum of the block falling pulls up the girl figure attached to the other side of the string.



# Cost of Machine and Percent of Recycled Materials Used

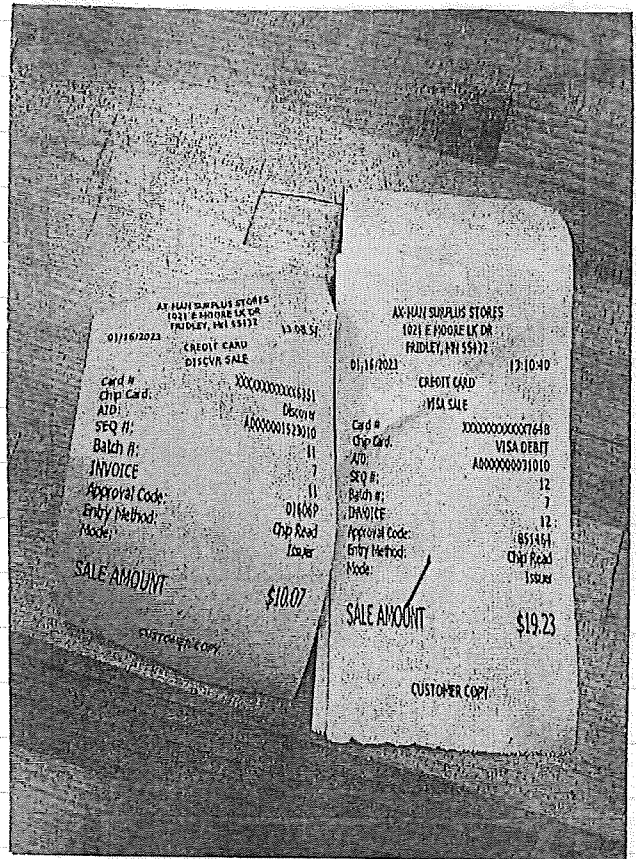
# shopping trip to Axeman



google  
maps

Axeman Surplus store  
St. Louis Park MN  
(952) 935-2210

Friday, January 20<sup>th</sup>



Past group total \$28.82

Total money spent:  
\$ 13.93  
+ \$ 10.07  
+ \$ 19.23  
+ \$ 28.82  

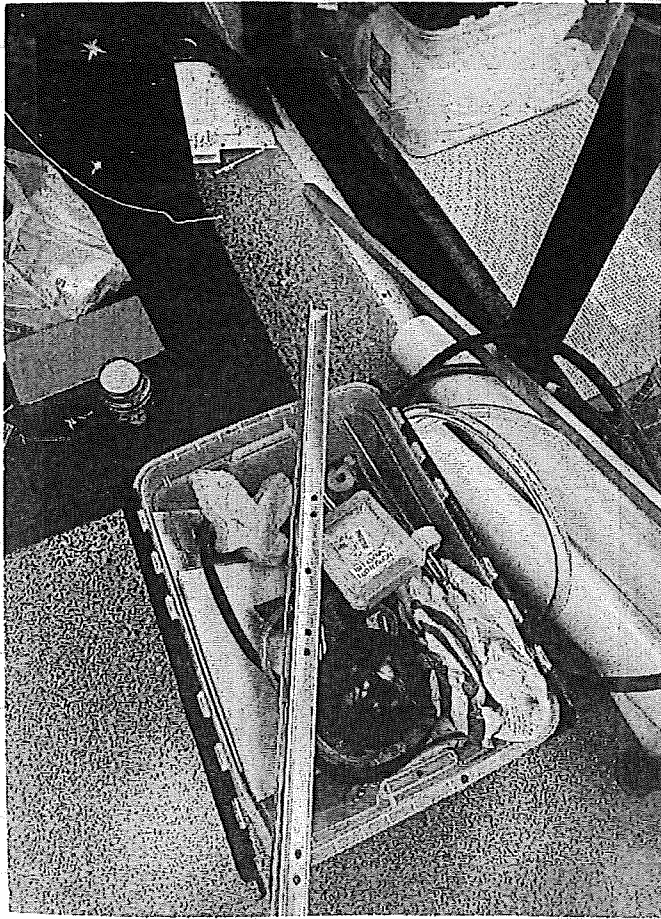
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\$ 72.05

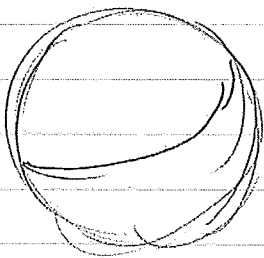
Overall money spent: \$233.44

Total % recycled: 70

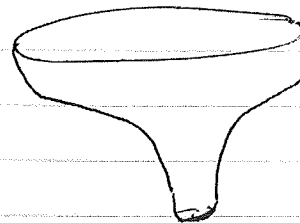
# Ax-man supply list



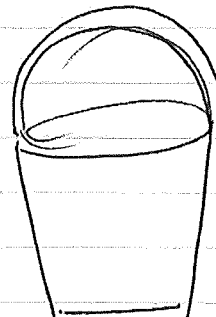
- 15 - tracks (painted black)
- 2 - buckets
- 1 - lightbulb (pulley)
- 1 - Big red ball
- 2 - syringes
- 8 - clear tubes (not used)
- 1 - Funnel



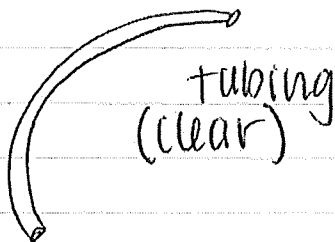
detachable ball



funnel



- bucket



tubing  
(clear)



Rolley Tracks

# Materials List + Cost

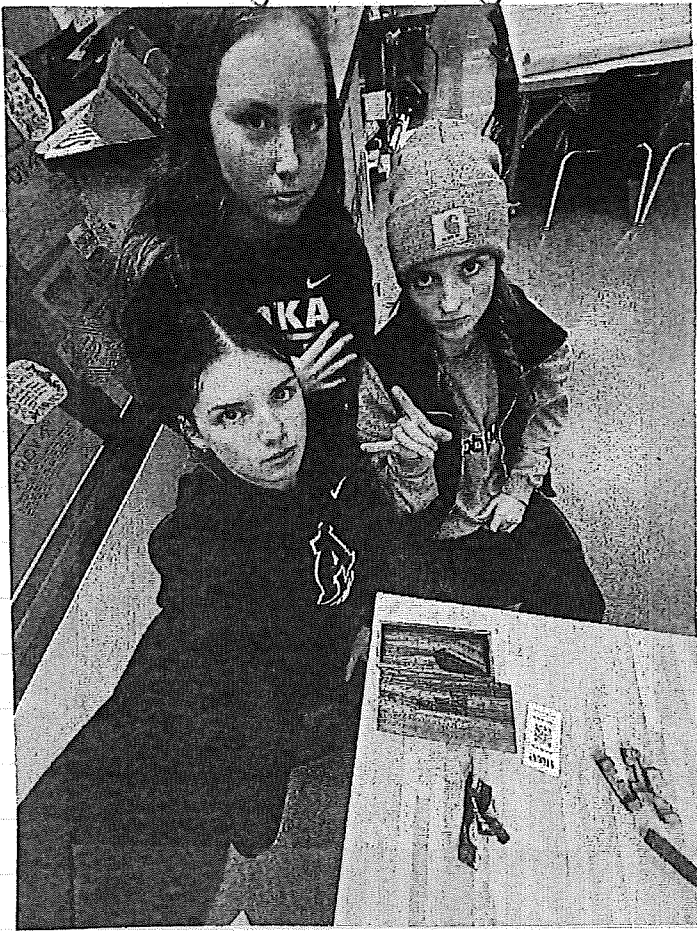
Bolt		1	recycled	
Buckets		3		\$0.99
Cardboard	{1inx1in 1.5inx3in & 2inx3in}	future	recycled	
Clear Tubing	3ft			\$1.00
Copper Tape	1 ft		recycled	
Funnel		3	recycled	
Girl Figure		1	recycled	
Golf Ball		4	recycled	
Hollow Plastic Ball		1		\$0.50
Hose Clamp		1		
Hot Wheel Car		1	recycled	
Hot Wheel Tracks		2	recycled	
Hydrogen peroxide	1 Bottle			\$0.99
Lightbulbs		1		\$7.99
Mason Jar		3		\$1.00
Metal Brackets	3-Present		recycled	
Metal Hinges		4	recycled	
Metal wire	6in		recycled	
Microbit		1	recycled	
newspaper (backgr	from: library		recycled	
paint (background)	from: dad's home improvement proj		recycled	
Paper	3 sheets		recycled	
Plastic Brackets	19-present 14-future		recycled	
Plastic Tracks		16		\$0.25
Screws		46	recycled	
Straw	1in		recycled	
String	4 1/2 ft		recycled	
String	3ft		recycled	
Syringes		2		\$3.50
USB cord			recycled	
Washers		6	recycled	
Water Bottle		1	recycled	

Wood Boards		1	\$200.00
Wood Circles		11	recycled
wood palet and wa	from: reused wooden palets and us		recycled
Wooden Block		1	recycled
Wooden Dowel	3 1/2ft		recycled
Wooden Platform		6	recycled
Wooden Spool			recycled
Yeast	3 packets		\$0.99



# Applied STEM Processes

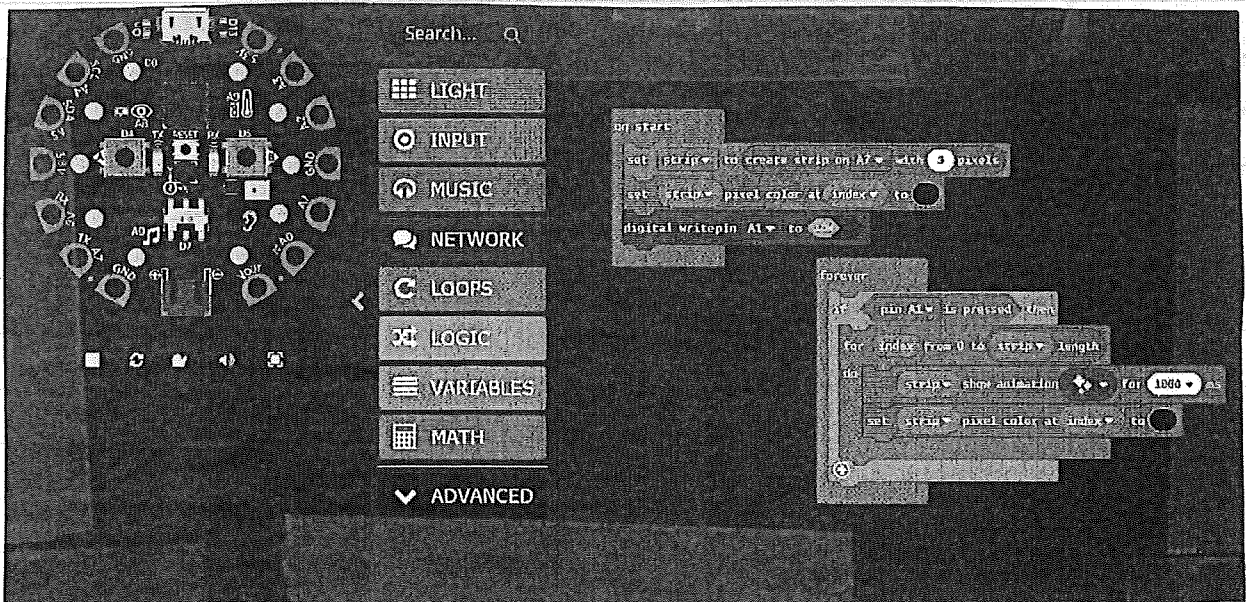
Saturday, February 4th



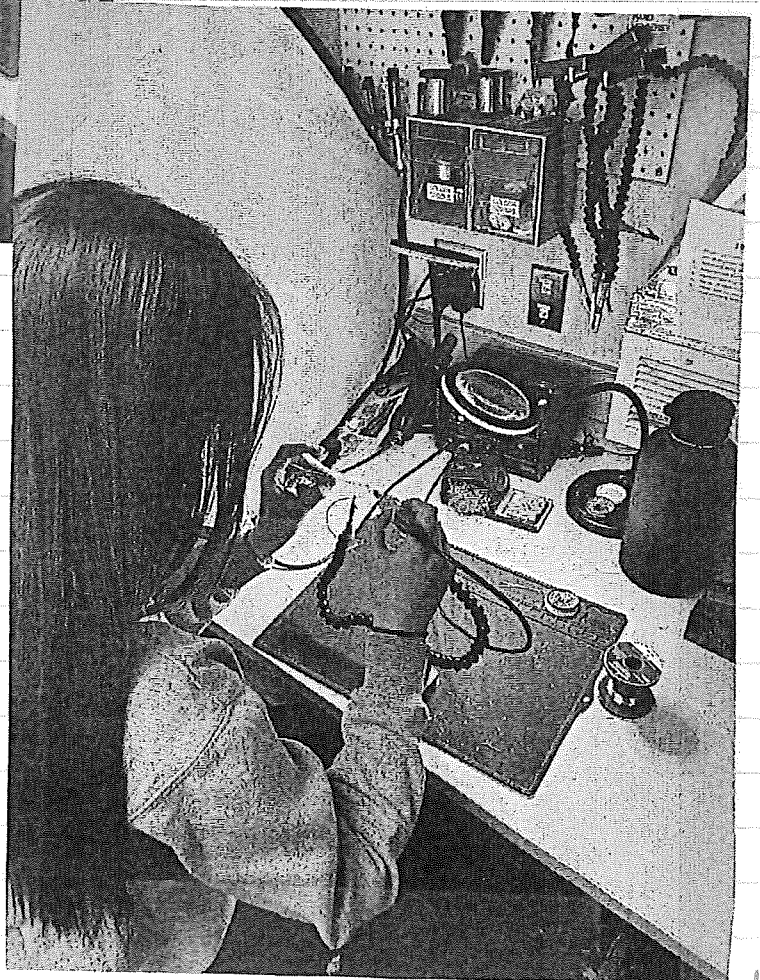
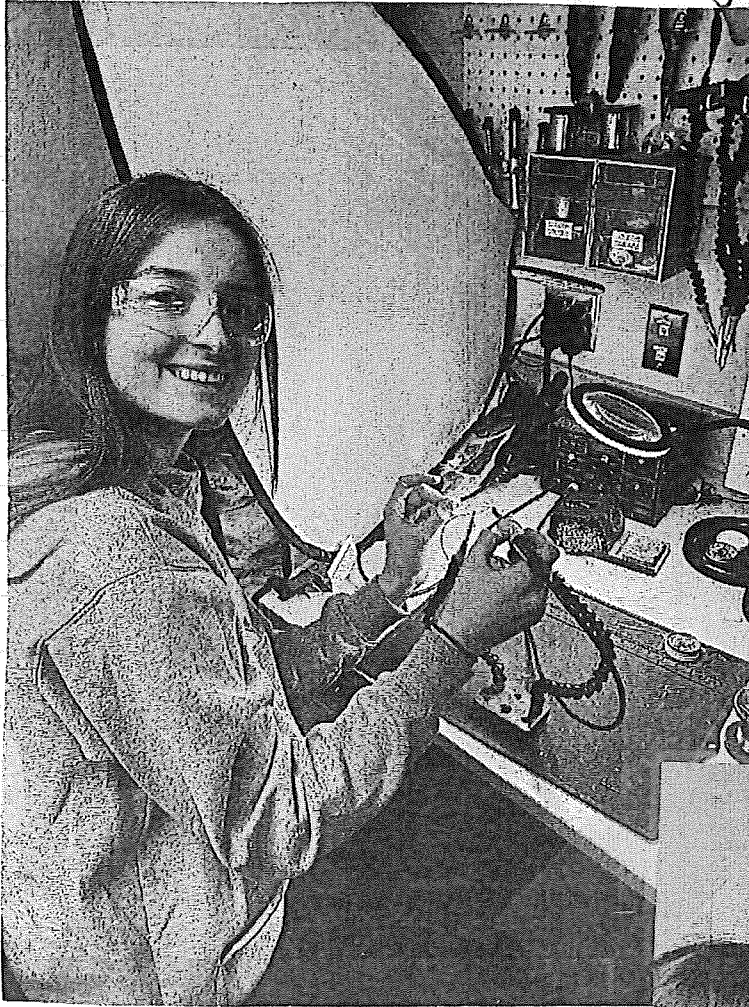
As a team, we decided to come in on a non-school day to ensure that we had ample time to design & complete our project.

We learned about:

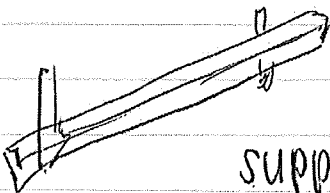
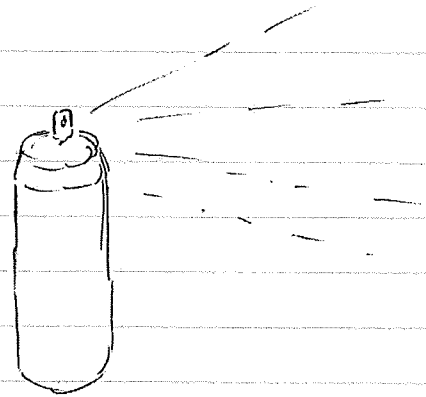
- Lazer cutting
- soldering
- 3D-printing
- circuitry
- Mathematical Applications
- chemistry



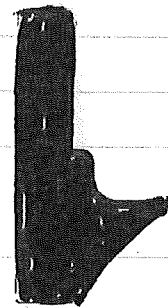
# Learning soldering skills!



3D printing & spray painting final brackets

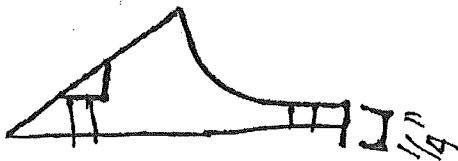
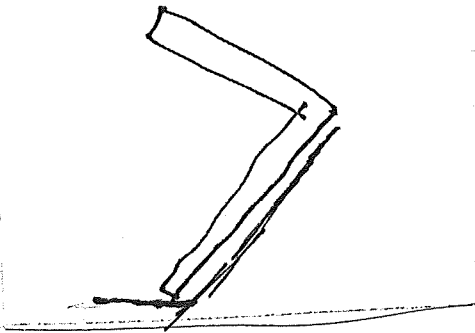


support the track





# 3-D printing $\frac{1}{3}$ Designing brackets



Printer  
Filament





# What We Improved On After 3/31/2023

## Overall:

- Journal Organization
- Appearance of Machine

## Past Group:

- 1st Step: Screws + Funnel
  - We adjusted the angle of the funnel as well as the amount (weight) of screws. This made our first step more accurate.
- Domino placement:
  - Our last step before the present side where dominoes pushing a ball onto a ramp. The problem was the dominoes were very shaky and weren't always accurate. We adjusted the placement of the dominoes therefore fixing the issue.

## Present Group:

- Fluid Component / Water Pressure Mechanism:
  - Improving the consistency on this component
- Car pulley system:
  - Stabilizing the pulley

## Future Group:

- Pulley system:
  - We changed the doll face to a rocketship to make the overall look more pleasing to the eye.

# Reflection

+

BIBLIOGRAPHY!!!

## Reflection:

The six months that we have been laboriously working on this project have been a journey of learning and self-growth. Though this journey has been difficult at times, it ultimately turned out to be a very rewarding experience. Through this design process, we have cultivated new skills including circuitry, soldering, lasering, and 3D printing. And more importantly, we have learned how to operate effectively and empathetically as a team.

We would be in dissent if we tried to proclaim that this process was "easy" and that we faced no obstacles. So to exercise honesty, we acknowledge that we have had many challenges over the last six months. Our main obstacle was simply time. Many of us are involved in varsity sports and extracurricular activities that demand a large portion of our time. As a result, it was very difficult for us to get all 10 members together to make plans and make a great quantity of progress. We had many late school nights and long weekend work sessions in order to make up for lost time after school. And while we struggled to find work time, ultimately we are for the better as our time management skills have never been stronger.

The most important lesson that we learned from this process was the importance of teamwork. Our teamwork skills are what ultimately led us to our success in completing the machine, as great ideas do not occur in a vacuum but rather in a collaborative environment. Designing the Rube Goldberg Machine required us to work collaboratively and be more empathetic towards each other's struggles. This was not always easy. One thing that we as a group struggled with agreeing on was where on the board we should put the transitions for the next time frame.

There are two groups on either side of each time transition: one between past and present, and one between present and future. The problem was that each group working on its respective time frame had visions of how they wanted to start and end their section. However, the sections that had a transition in between them had to line up. In order to solve this problem, each of the groups communicated effectively with each other and compromised when necessary. As a result, we were able to create a cohesive plan and an even more cohesive team.

Another important lesson we learned was how necessary it is to fully engage in the design process. Initially, we were impelled to jump right into building our machine without any preparation or planning. However, as we quickly tried to push ideas and objects onto the board, we were met with chaos. Thus, we realized how essential it was to immerse ourselves in the full

design process. We went back to the drawing board, first making intricate sketches for all of our ideas. We then made prototypes to test out our more "risky" steps and examine them for flaws. In the future group, we found with one of our prototypes that our ball would not have enough momentum to knock down a tower of wood. So we kept adjusting the incline that the ball was rolling on and the position of the wooden tower until we had a successful reaction. If we had just skipped right to putting this step in our machine, we would have been faced with a failed step in the middle of our design, which would have led to excess stress and chaos. Overall, we learned that planning, testing, gaining insight, and ultimately retesting were crucial parts of making our machine, as they allowed us to improve and refine our design so that all the reactions could proceed effectively.

We also gained an appreciation for the many hard skills that go into engineering a machine of this magnitude. One problem we had while building our machine was attaching our slanted tracks to the flat wooden walls. To solve this problem, one of our group members, Courtney, had to learn how to 3D print. She designed and printed hinges that allowed for the tracks to lay flush against the walls. Another one of the group members, Annie, had to learn how to solder in order to securely connect the different parts of our electric circuit. She also had to learn patience as she spent long amounts of time carefully melting the metal without making a mistake and wrecking the whole circuit.

We would be misguided if we did not mention the importance of our theme in the success of our project. Because we are a team of all women, we knew how important it was to incorporate successful women in STEM into our project. Throughout history, women have faced much discrimination in the STEM fields, and oftentimes their work has gone unnoticed. But we wanted to celebrate all of the amazing contributions and advancements that they have made to STEM, and more specifically, space. So we highlighted various brilliant women in our past section, including Sally Ride, Mary Jackson, and Katherine Johnson. Our ending step also features a woman landing on a planet to signify our prediction: that a woman will break the glass ceiling and land on Mars. We know it was crucial to do this theme to not only challenge traditional gender stereotypes but also to inspire the millions of young women to take charge and make a difference in STEM, just as we have ourselves.

In conclusion, the journey of making our Rube Goldberg for the Machine Design Contest has been challenging but fruitful. As we all go on to our future careers as engineers, politicians, and doctors and become the future builders of the world, we can use these skills that we have

learned to find true success. We also wish that our hard work, courage, and dedication to this project will inspire all the young girls in the world to go into STEM and take the world by storm.

### Bibliography:

ASTC Science World Society. "Build a Circuit." 6 Nov. 2015.

<https://www.scienceworld.ca/resource/build-circuit/>

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Soszynski, Sarah. "Science At Play: Rube Goldberg Machines." Connecticut Science Center, 12 May 2020, <https://www.scienceworld.ca/resource/build-circuit/>

STEAM Fest. "Rube Goldberg Machines." Wood Lawn School, n.d.,

<https://steamfest.woodlawnschool.org/activity/rube-goldberg-machines/>