STUDENT EXAMPLES OF PROJECT COMPONENTS

Simple Machines Design Challenge

PHOTO TIMELINES

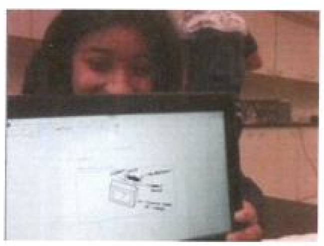
Design Phase:

Step 1- **Brainstorming**

In this step, we came up with the general idea of our catapult, the jobs, and organized our thoughts.

Step 2- **Sketching**

Here, we started to come with an idea of what we wanted to have in the catapult based on our brainstorming.



Step 3- **Prototype**

In step 3, we started to figure out our measurements, supplies, and set started to set up the idea to figure out how to build it based on our sketches.

Lena, Ben, Juliana, and Jay.

A locker that was used for reference during the brainstorm process to put our ideas to scale.

This is our group looking at the supplies available to us.

Our group debating whether we should use an actual pulley or the bar provided in our lockers.

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Construction Phase:

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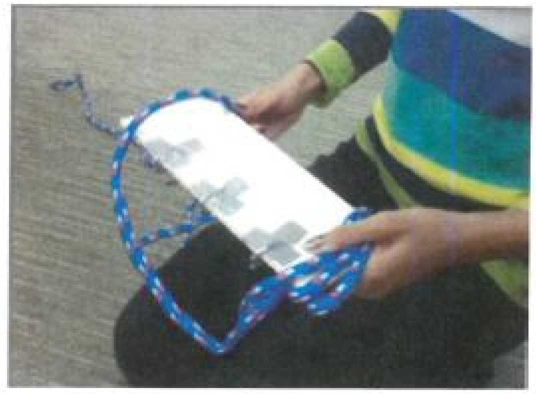

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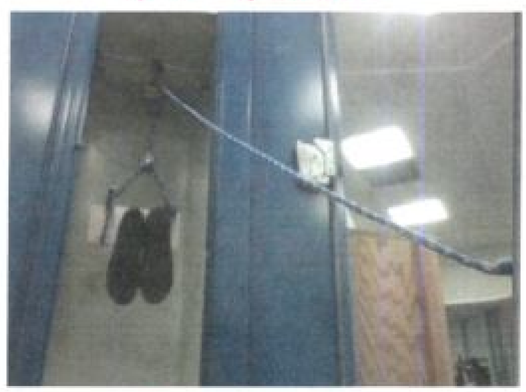

4th - data collection

This is the construction of the wooden frame

Us measuring and seeing where to place the elastic band.

This is us testing to see if fabric will work to hold the newspaper.

This is the frame and us attaching the elastic band to the frame with nails.

Ben hammering the last nail that goes into the frame.

The group deciding which way to hold the newspaper well launching it.

Jay testing out how the slingshot will work.

SUPPLY LIST & BUDGET

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3 nails			4	
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elastic band ✓			1-2	
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DESIGN & CONSTRUCTION DETAILS

Instructions & Diagrams:

~Locker Pulley~

1. Hot glue the hooks on to the wood where the dashes indicate. See picture one.
2. Tightly wrap one piece of rope to either end of the wood, leaving excess rope in the middle loose. See picture two.
3. Tie another rope to the excess loose rope. See picture three.
4. Put the smaller rope through the hole at the top of the pulley and around the bar in your locker. Connect the two ends and hot glue them together.
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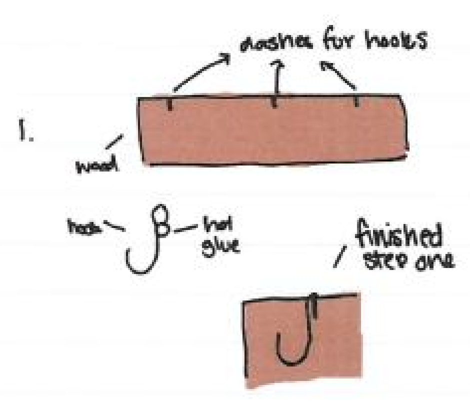
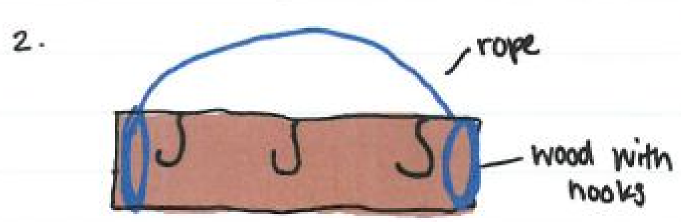
6. Attach desired items onto hooks and utilize this simple machine!

NOTE

Once the item has been pulled to hang in the air to the desired height, wrap the pulled end of the rope around one of the locker hooks to keep your items in place. See picture five for reference.





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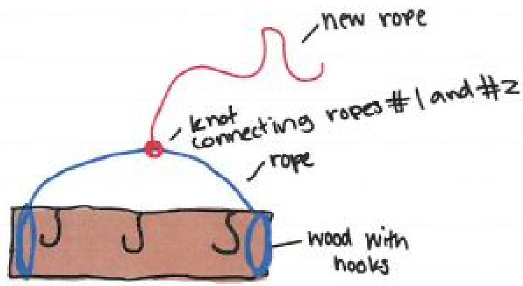
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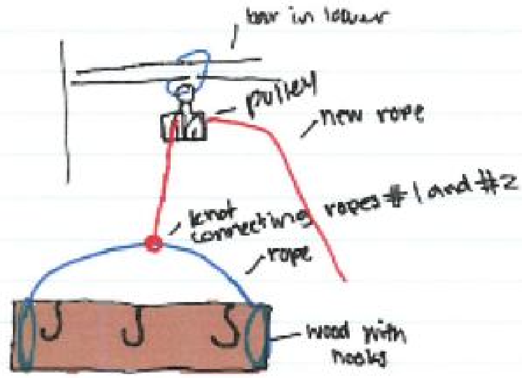
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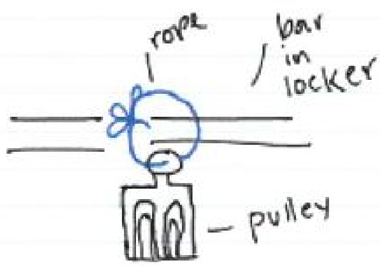
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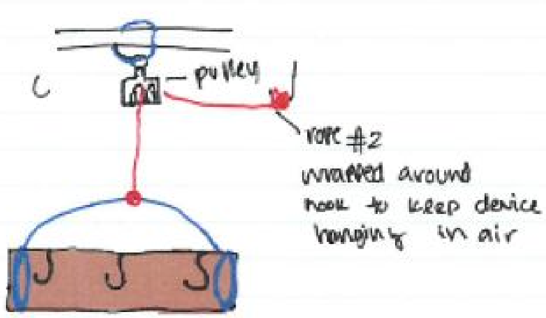
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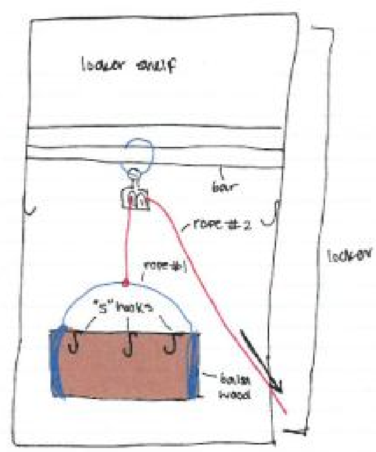
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~Projectile Launcher~

1 Use 2 wood planks to make a L
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3 Repeat steps 1-3 again
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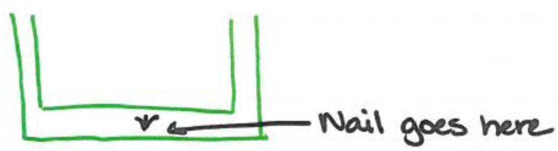

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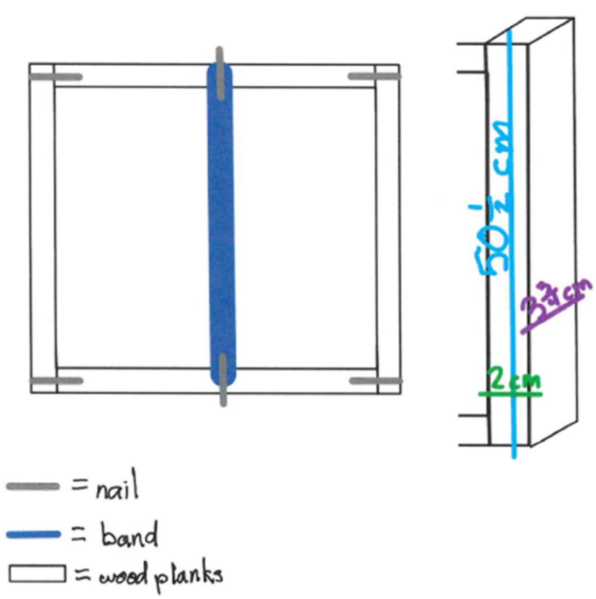

DATA COLLECTION/MATH CONCEPTS TABLE

PART 3: CONSTRUCTION + DATA COLLECTION

Type of machine constructed ~

Projectile B

Task to complete ~

Launching a newspaper B

Data Collection ~

TRAJECTORY LAB DATA TABLES

**** Complete the below with the whole class ****

Horizontal Time:

Trial	Time for dart to travel 6m horizontally (seconds)
1	N/A
2	
3	
Average (t_H)	

Horizontal Velocity (V_H): ______________ m/sec

**** Complete the below in your group ****

Distance Dart will be dropped from: 1 m

Vertical Time:

Trial	Time for dart to fall from firer's hand to ground (seconds)
1	.69
2	.63
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Average (t_V)	.66

Horizontal Distance your dart should travel (D_H): 0.5 m

!!!!! This is the distance away from your firer you should place your target!

Firing Data:

Trial	Accuracy? (yes/no)	Time dart was in the air (sec)
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Modifications ~

- Broke so we tried to duct tape/tie it together.
- Tried adding an elastic
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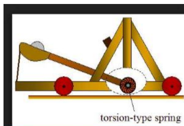
PRESENTATION

HISTORY OF THE CATAPULT

- It was used in the middles ages to help win battles and wars.
- Since castle walls were getting stronger, armies needed something that could break through them.
- Many kinds of catapults were used.
- Some are tension powered, trebuchet, torsion powered, gravity powered, and traction powered.



TENSION POWERED CATAPULT

Also a little more history

- Tension powered catapults have a long flexible arm, so that when the basket is bent backwards to give the weapon its throwing power, the arm won't break making the weapon useless in battle. The basket was tied or hooked in some way when bent backwards, so that large stones or other types of projectiles could be loaded into the basket. When the basket was released the projectile would fly into the air hopefully hitting the castle wall and causing part of it to tumble to the ground. Sometimes flaming projectiles were put in the basket. Upon impact the ball would burst setting fire to everything in a given radius. The tension powered catapult was often used for destruction of castle walls, but sometimes it was used as a defense weapon for the castle itself. The tension catapult was able to throw and shoot farther than most other types. It was also a better weapon than the ballista, as the catapult was portable with it's wheels.

HISTORY OF THE SLINGSHOT

- Is a small hand-powered projectile weapon.
- Was invented after the invention of elastic/rubber.
- Late 1800s

SLINGSHOTS IN CLEVELAND

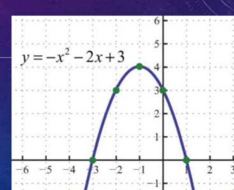
Slingshots are not used often, but when they are they are manly used for hunting and entertainment. Slingshots are used to hunt anywhere from small to large game. These include anywhere from squirrels and rabbits to large dear. Hunters could have used these while hunting.

PROJECTILE MOTION

- Projectile motion is a form of motion in which an object or particle (called a projectile) is thrown near the earth's surface, and it moves along a curved path under the action of gravity only. The only force of significance that acts on the object is gravity, which acts downward to cause a downward acceleration. Because of the object's inertia, no external horizontal force is needed to maintain the horizontal motion.
- Projectile motion is used in Cleveland in most sports games. For example, a baseball follows a parabola.

MATH CONCEPTS

The equation ax^2+bx+c is the equation of a parabola. This is the form of the equation that you will make using the iPads.



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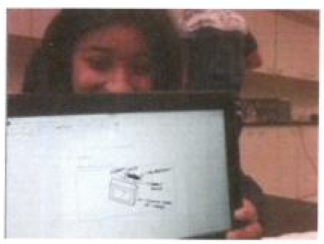

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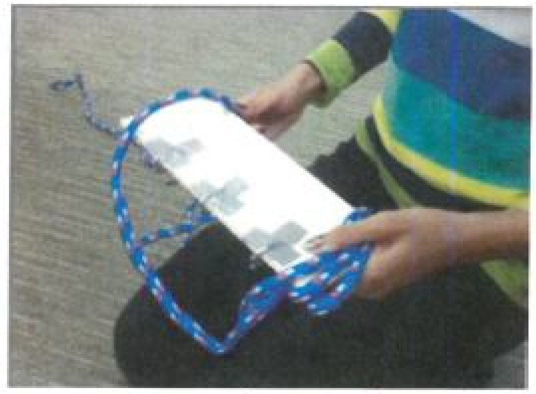

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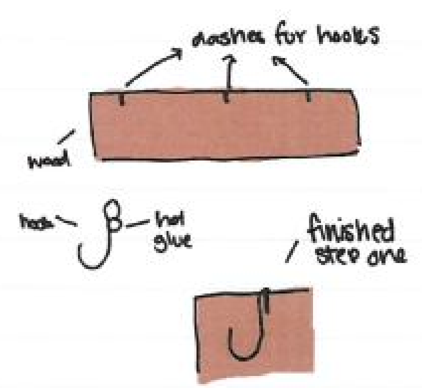

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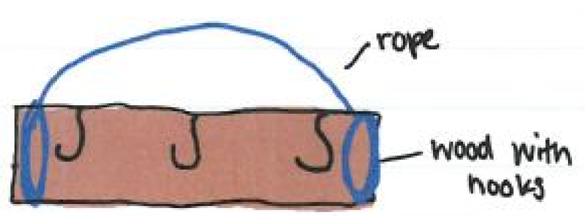

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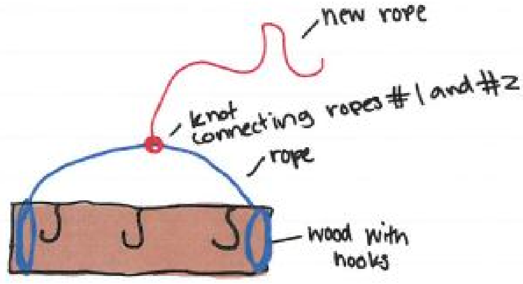
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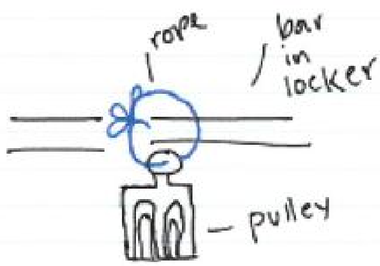
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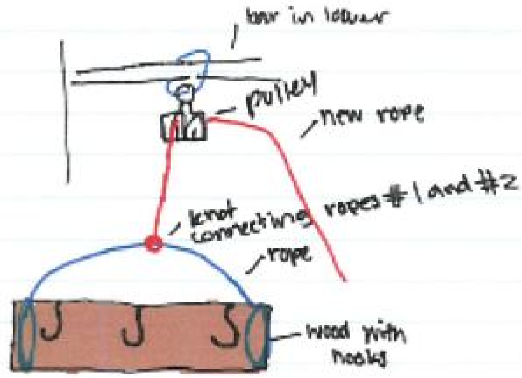
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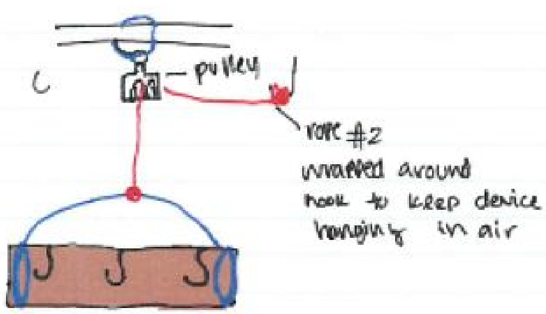
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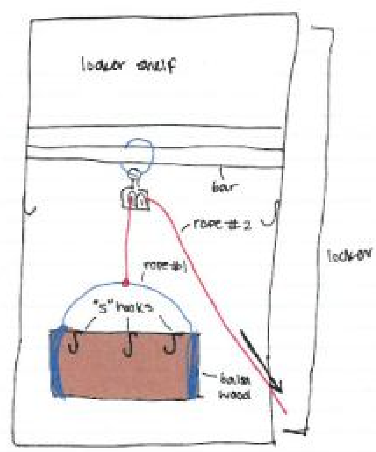
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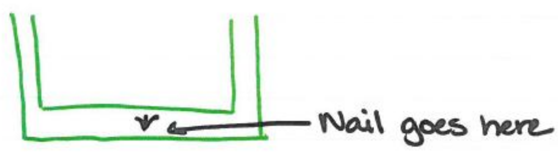

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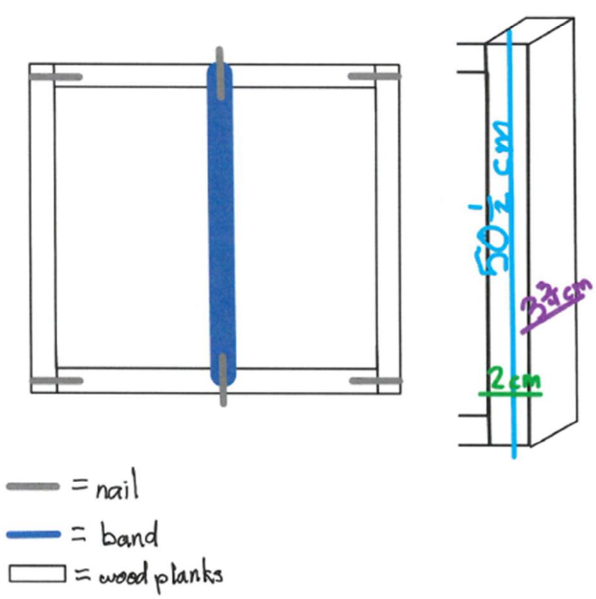

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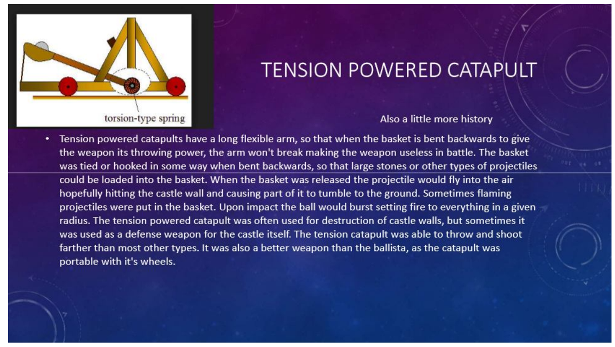

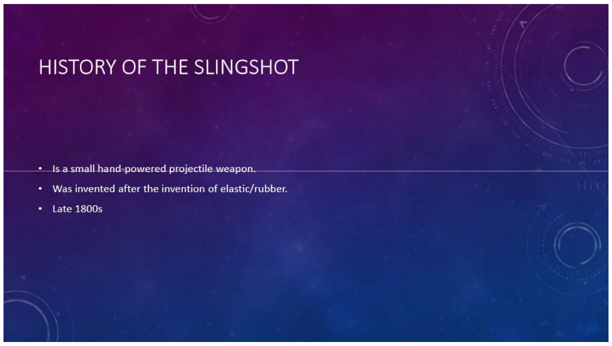

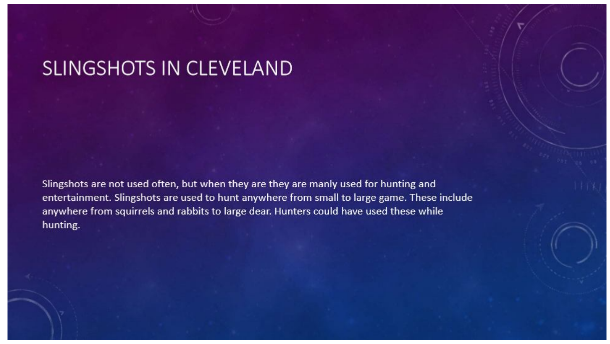

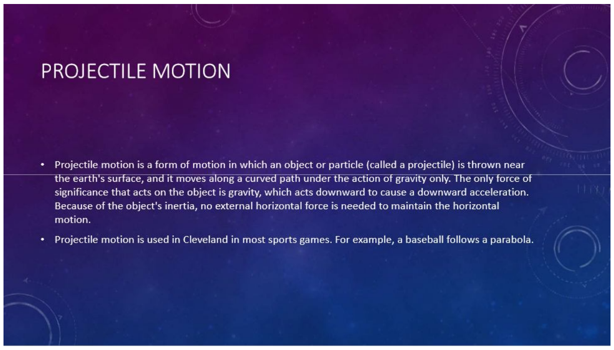

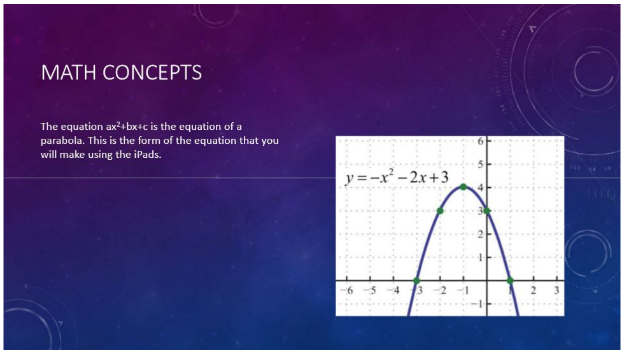

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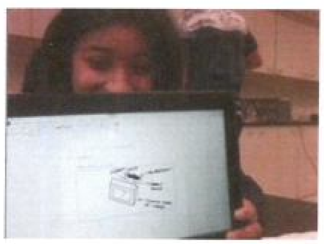

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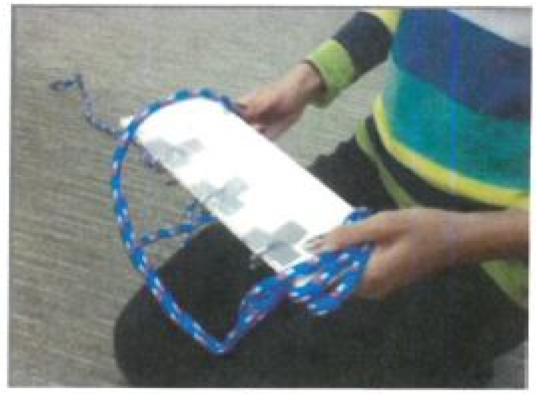

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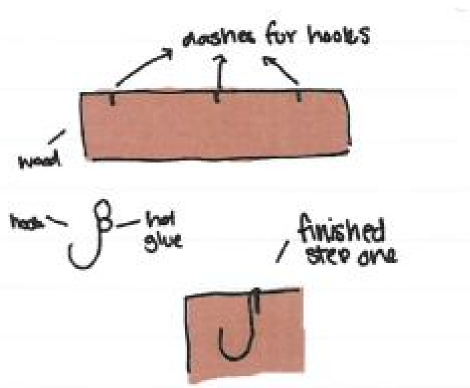

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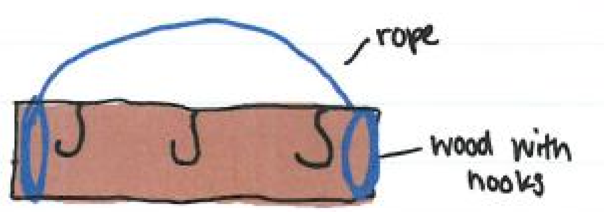

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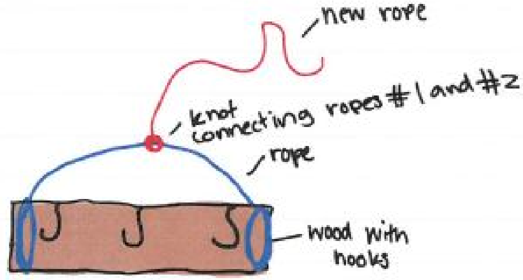
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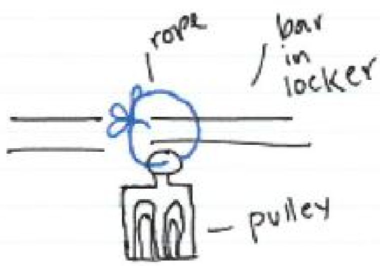
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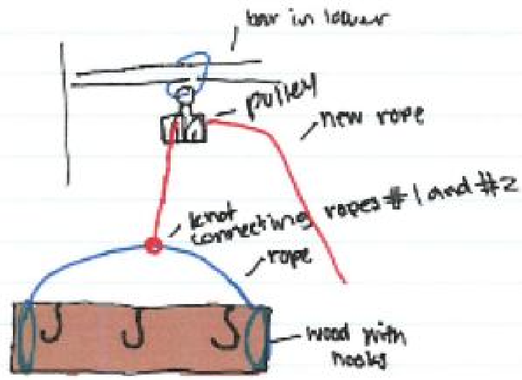
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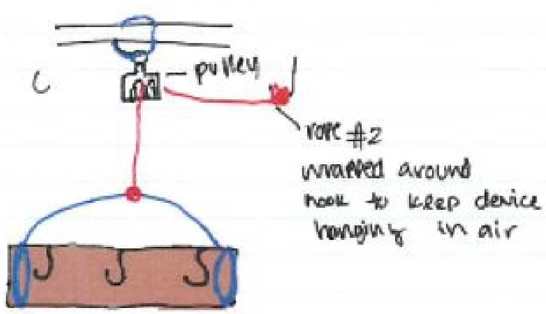
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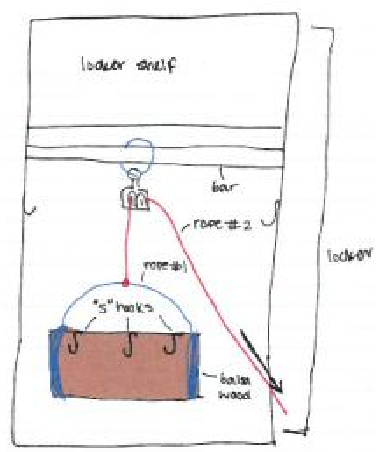
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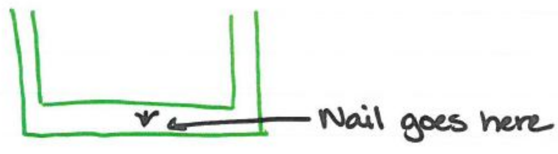

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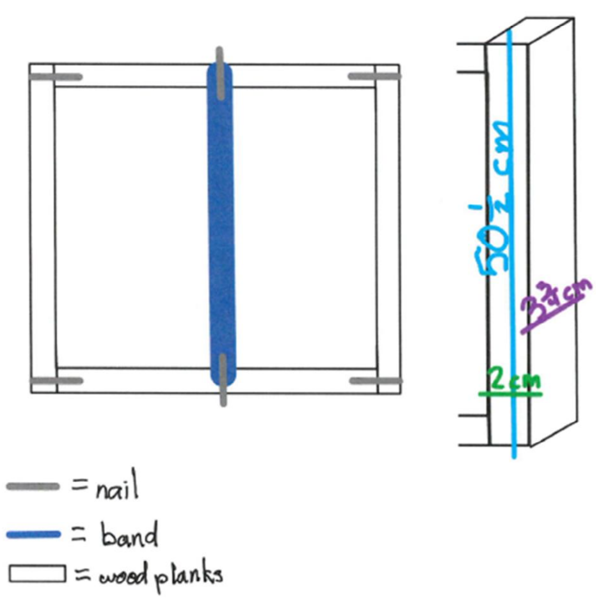

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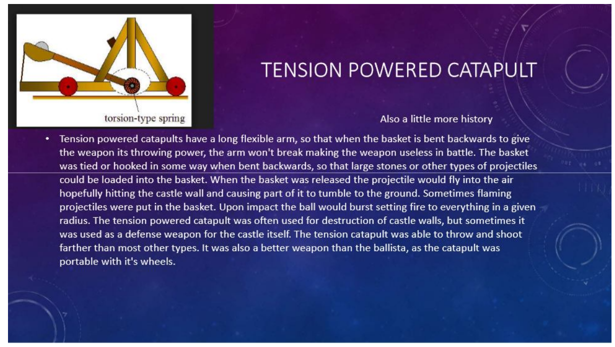

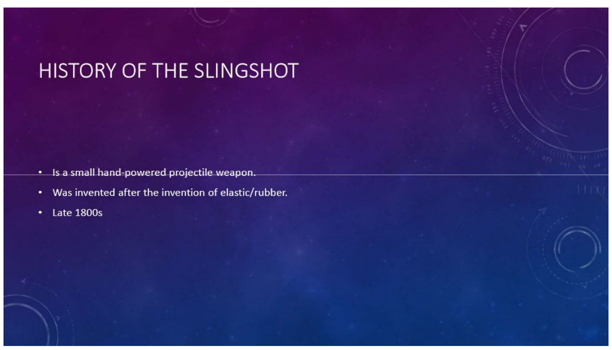

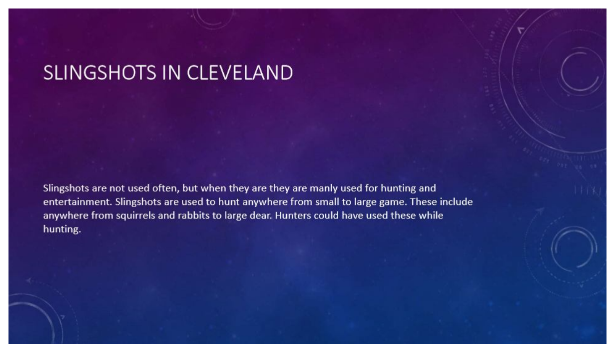

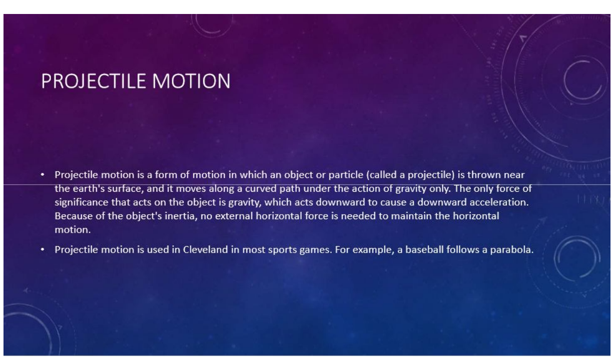

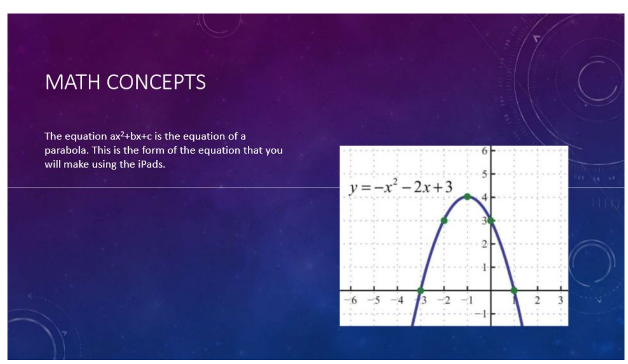

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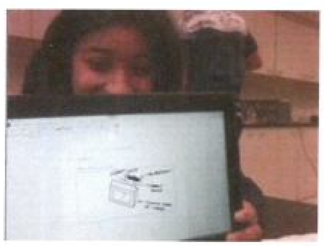

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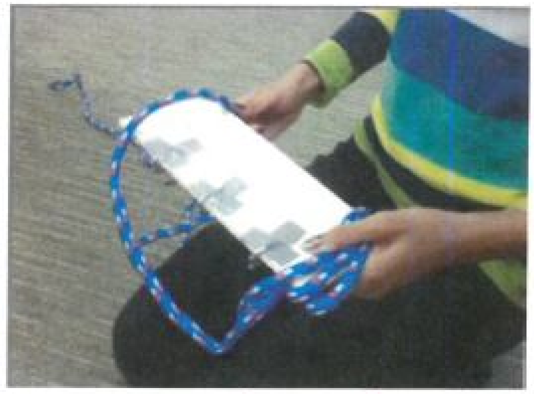

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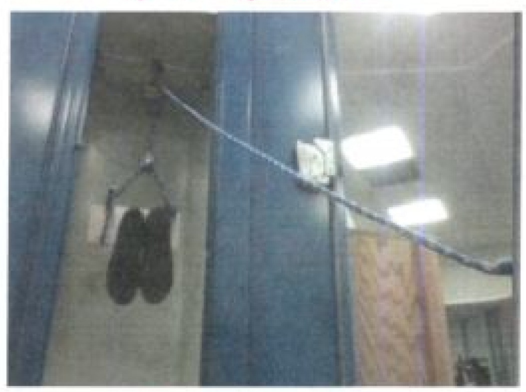

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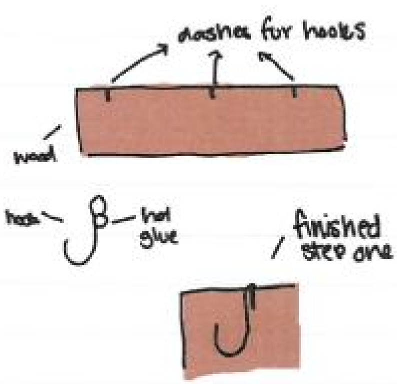

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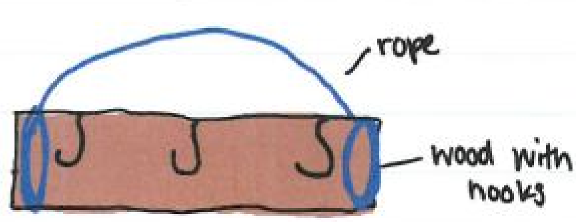

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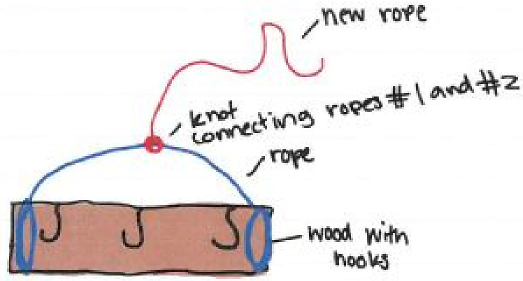
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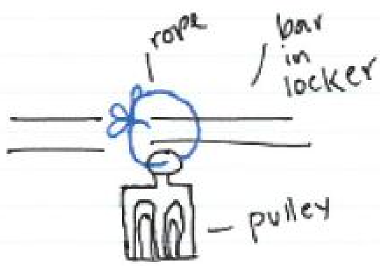
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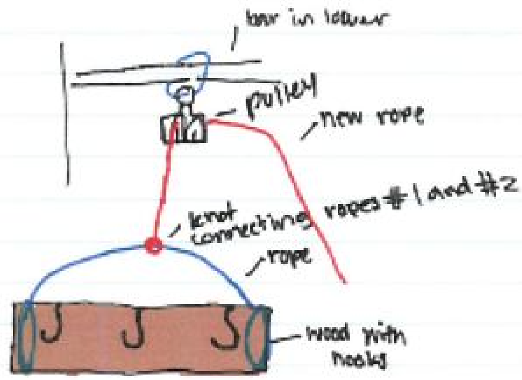
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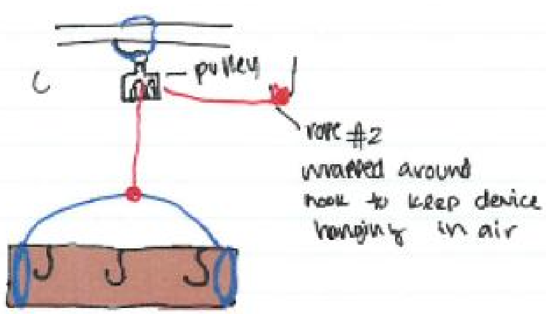
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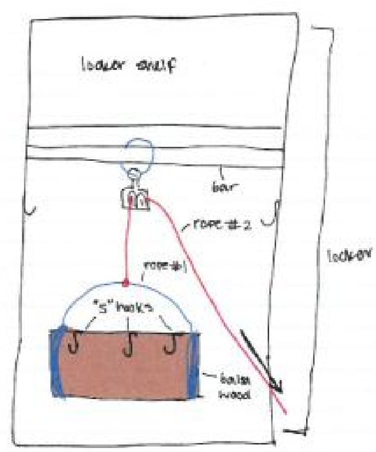
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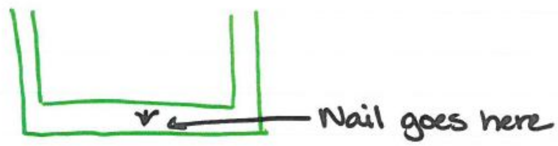

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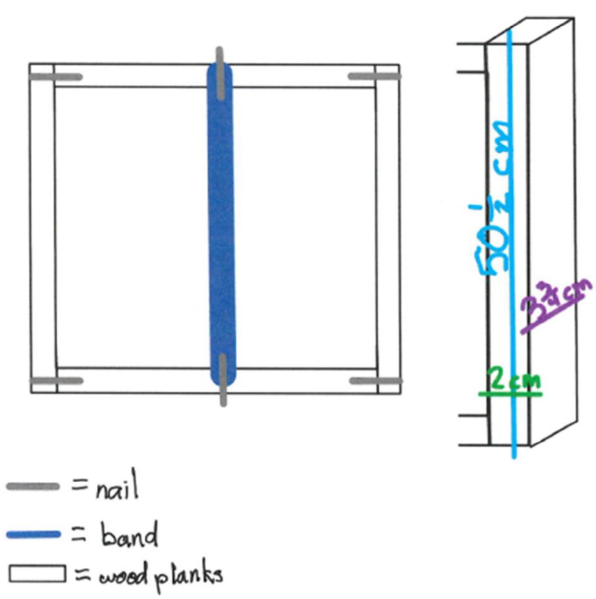

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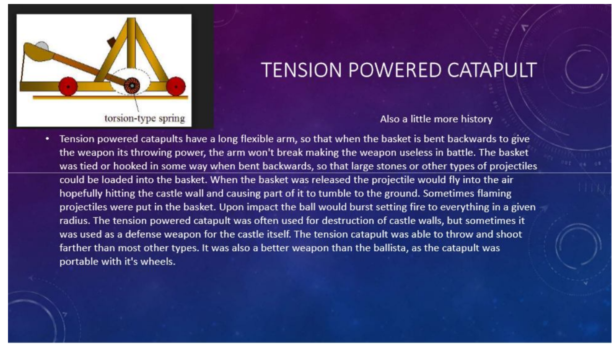

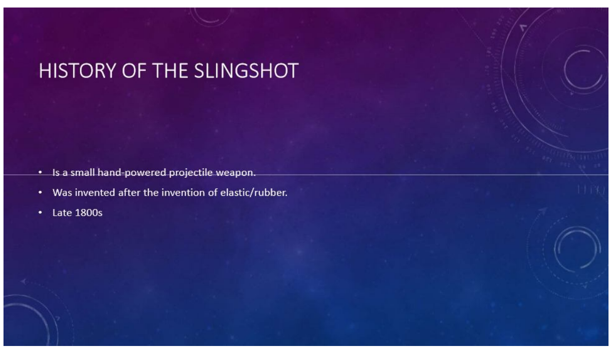

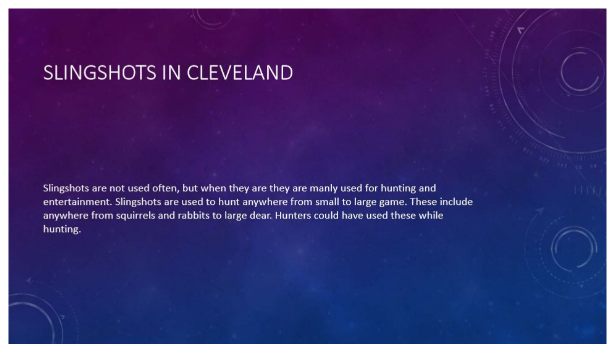

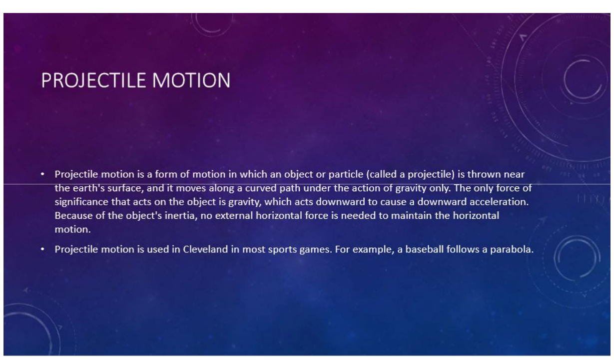

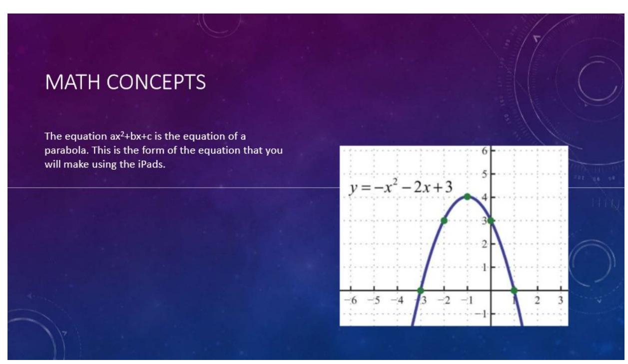

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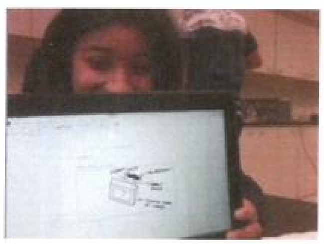

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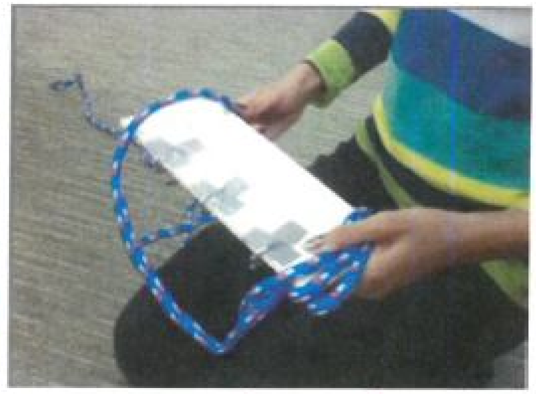

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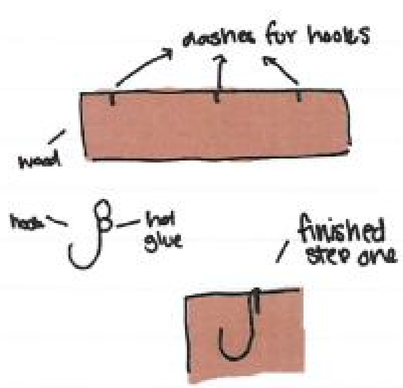

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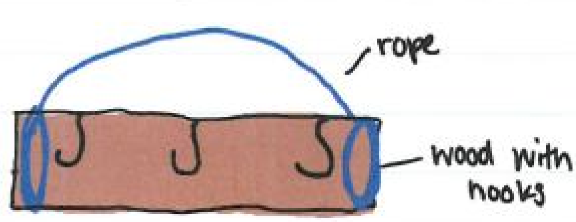

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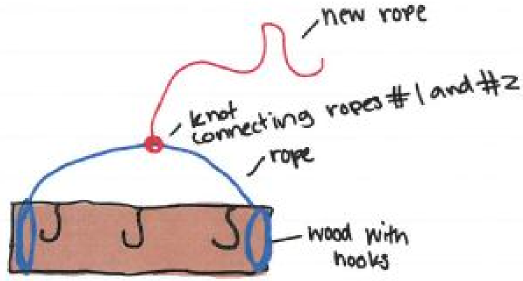
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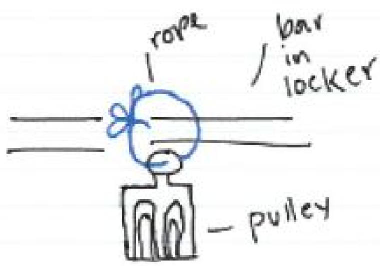
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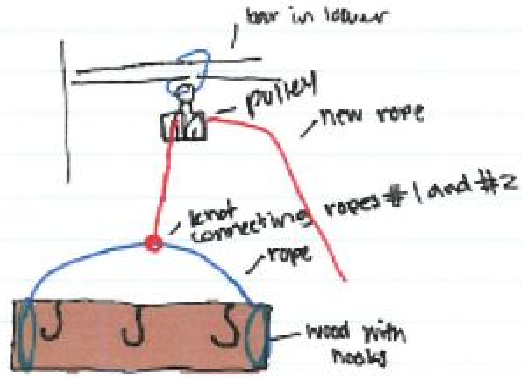
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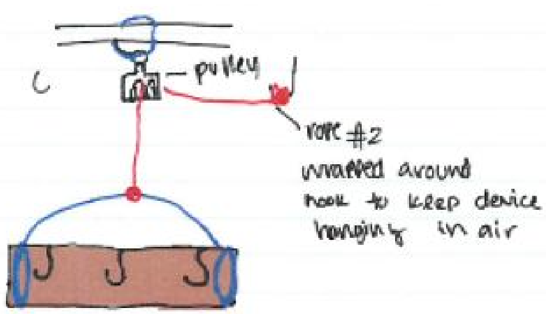
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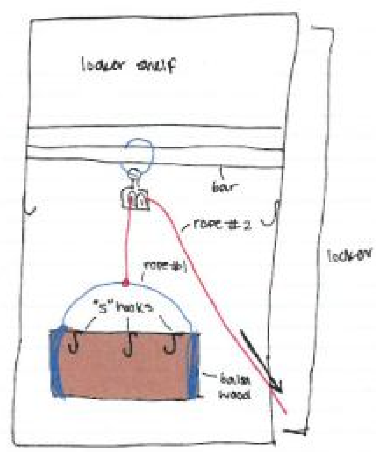
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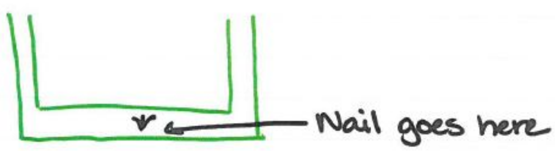

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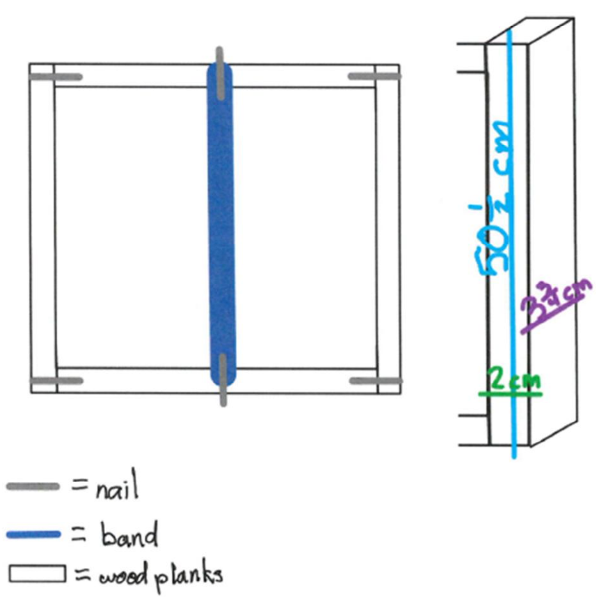

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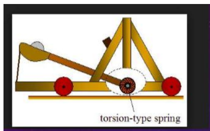
PRESENTATION

HISTORY OF THE CATAPULT

- It was used in the middles ages to help win battles and wars.
- Since castle walls were getting stronger, armies needed something that could break through them.
- Many kinds of catapults were used.
- Some are tension powered, trebuchet, torsion powered, gravity powered, and traction powered.



TENSION POWERED CATAPULT

Also a little more history

- Tension powered catapults have a long flexible arm, so that when the basket is bent backwards to give the weapon its throwing power, the arm won't break making the weapon useless in battle. The basket was tied or hooked in some way when bent backwards, so that large stones or other types of projectiles could be loaded into the basket. When the basket was released the projectile would fly into the air hopefully hitting the castle wall and causing part of it to tumble to the ground. Sometimes flaming projectiles were put in the basket. Upon impact the ball would burst setting fire to everything in a given radius. The tension powered catapult was often used for destruction of castle walls, but sometimes it was used as a defense weapon for the castle itself. The tension catapult was able to throw and shoot farther than most other types. It was also a better weapon than the ballista, as the catapult was portable with it's wheels.

HISTORY OF THE SLINGSHOT

- Is a small hand-powered projectile weapon.
- Was invented after the invention of elastic/rubber.
- Late 1800s

SLINGSHOTS IN CLEVELAND

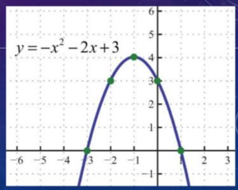
Slingshots are not used often, but when they are they are manly used for hunting and entertainment. Slingshots are used to hunt anywhere from small to large game. These include anywhere from squirrels and rabbits to large dear. Hunters could have used these while hunting.

PROJECTILE MOTION

- Projectile motion is a form of motion in which an object or particle (called a projectile) is thrown near the earth's surface, and it moves along a curved path under the action of gravity only. The only force of significance that acts on the object is gravity, which acts downward to cause a downward acceleration. Because of the object's inertia, no external horizontal force is needed to maintain the horizontal motion.
- Projectile motion is used in Cleveland in most sports games. For example, a baseball follows a parabola.

MATH CONCEPTS

The equation ax^2+bx+c is the equation of a parabola. This is the form of the equation that you will make using the iPads.



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Simple Machines Design Challenge

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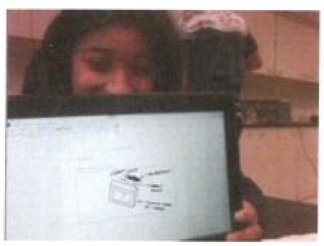

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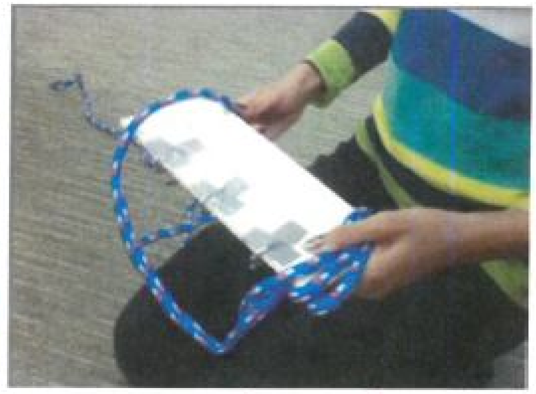

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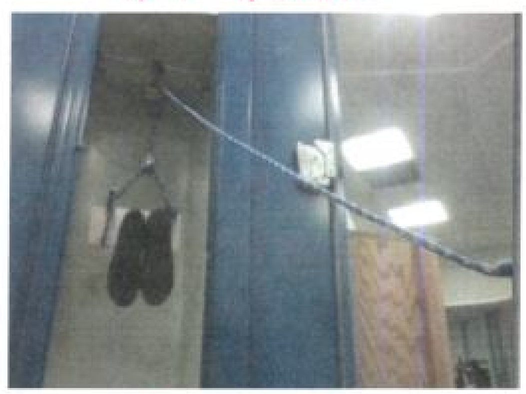

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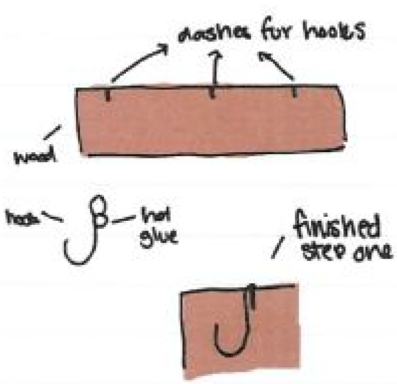

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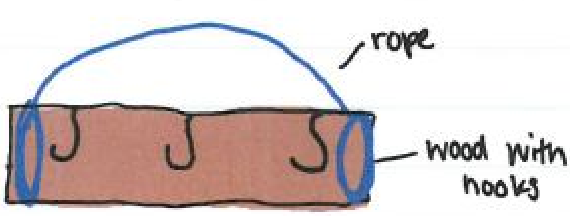

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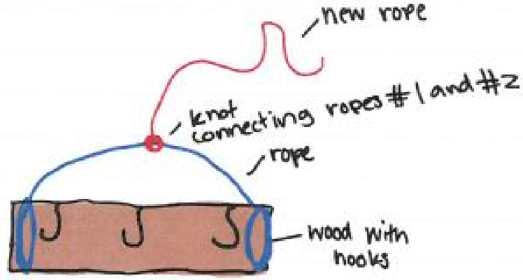
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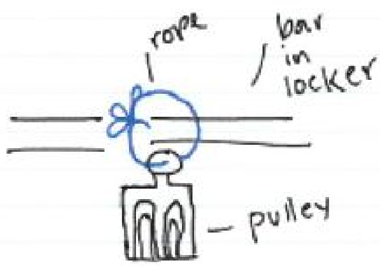
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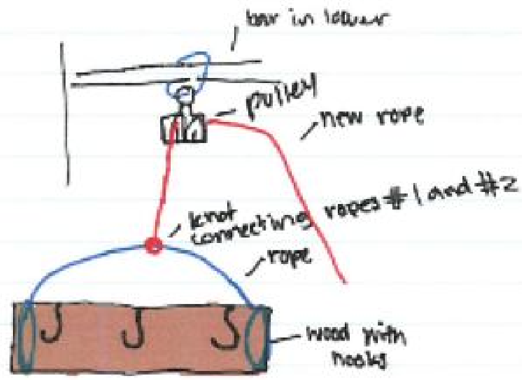
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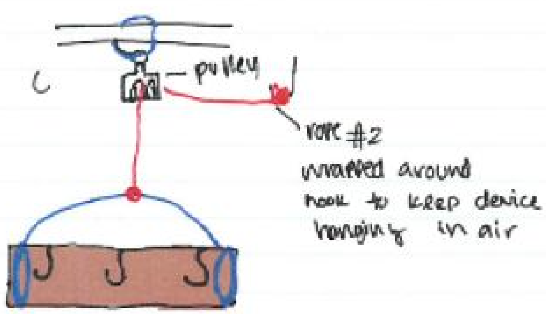
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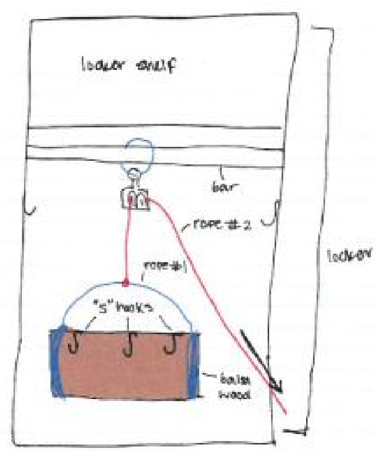
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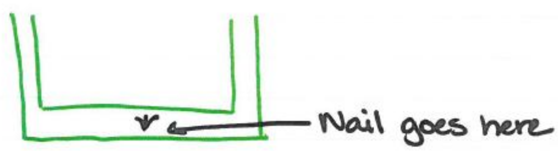

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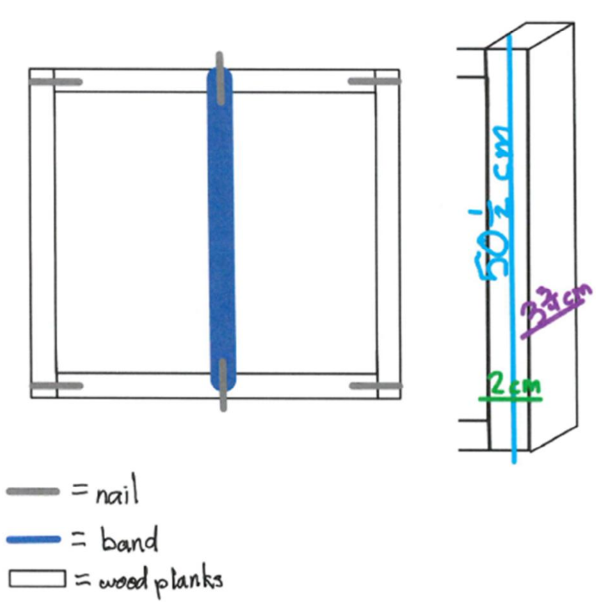

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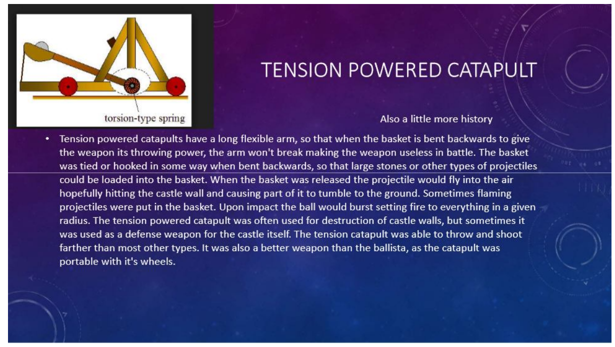

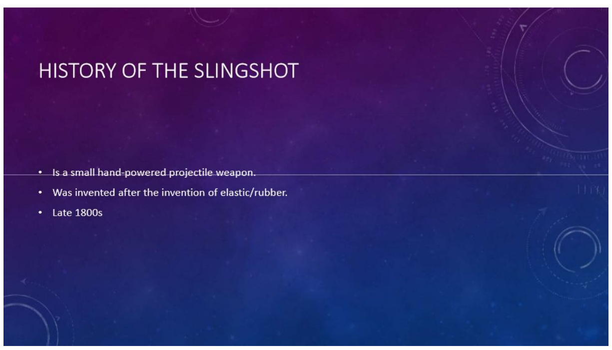

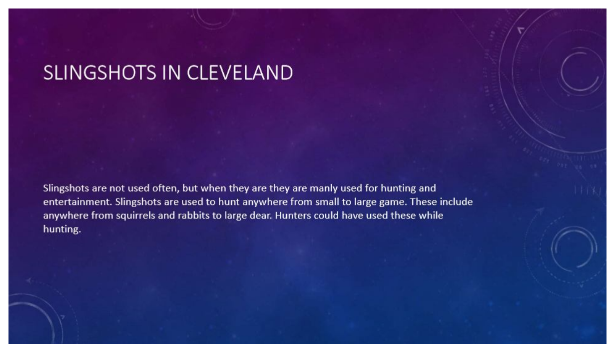

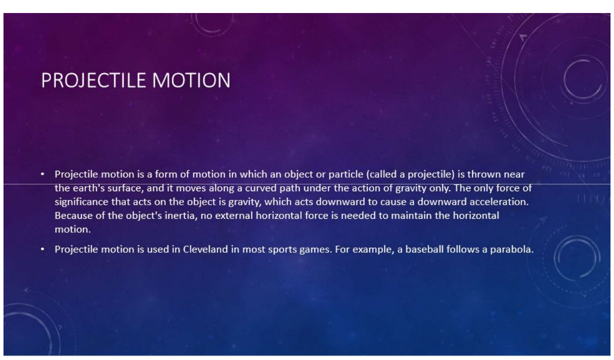

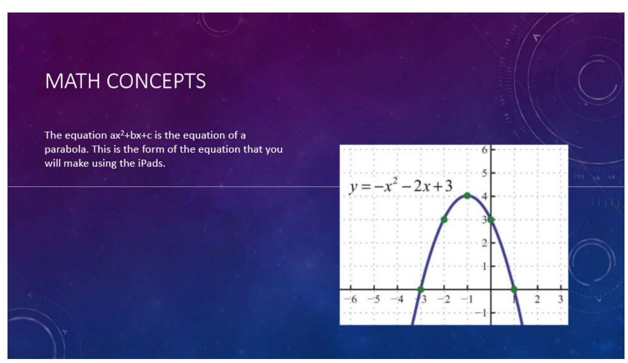

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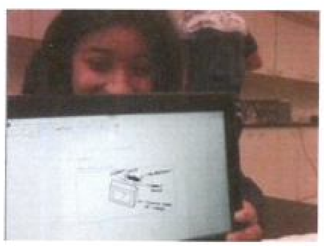

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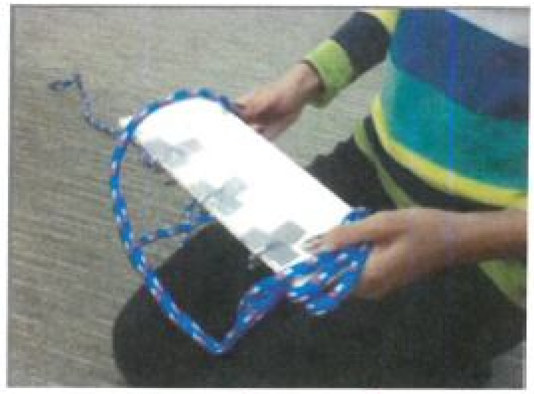

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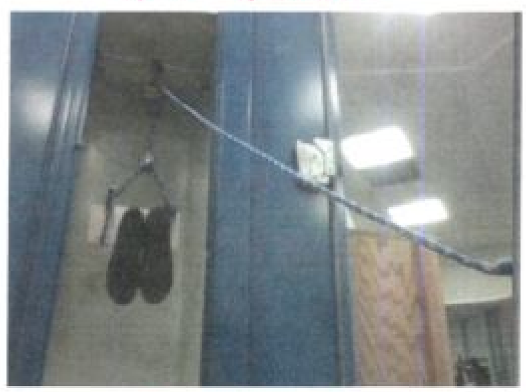

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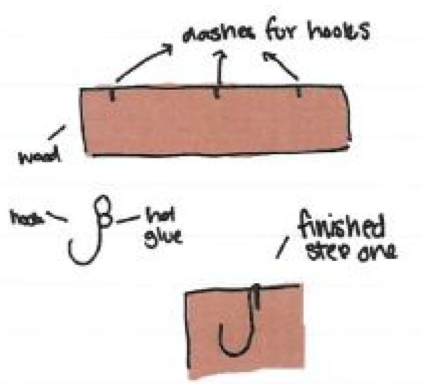

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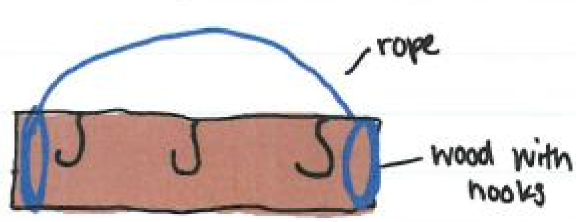

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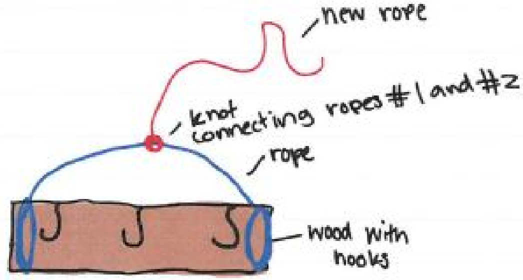
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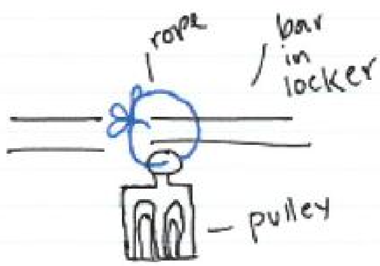
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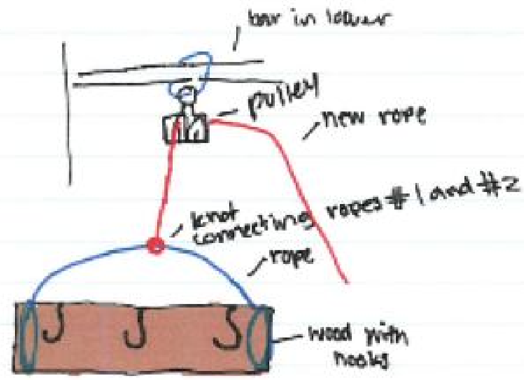
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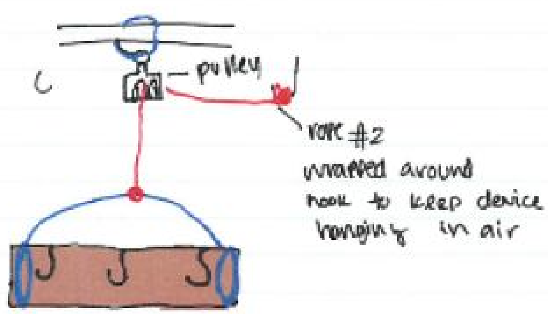
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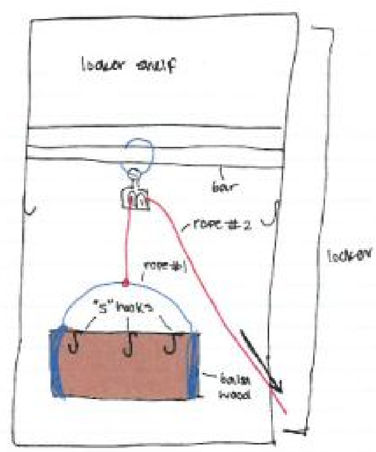
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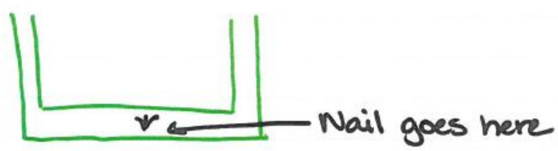

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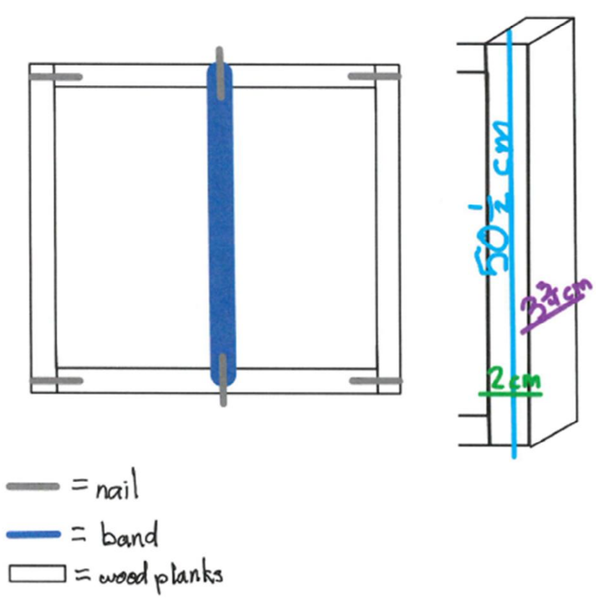

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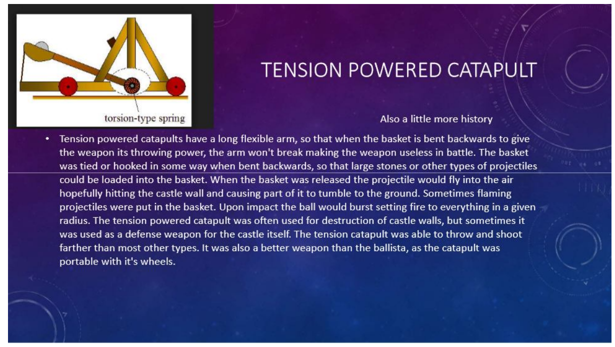

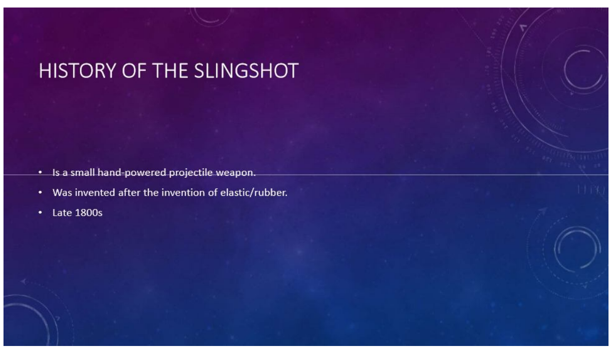

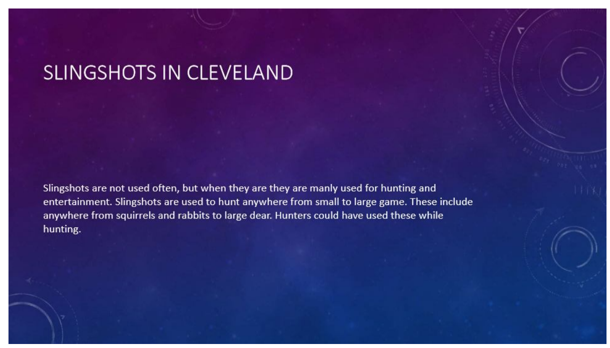

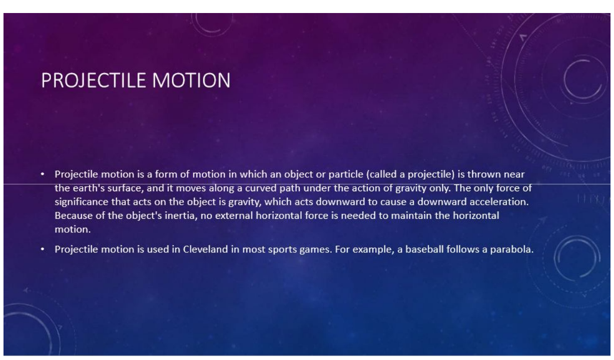

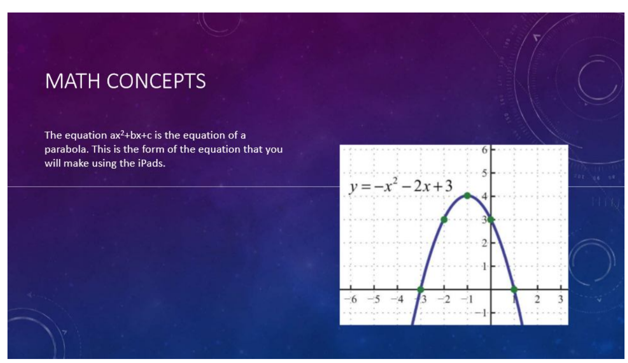

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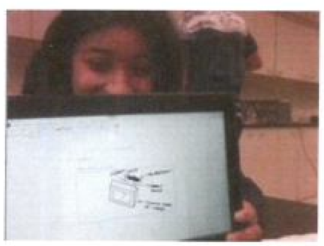

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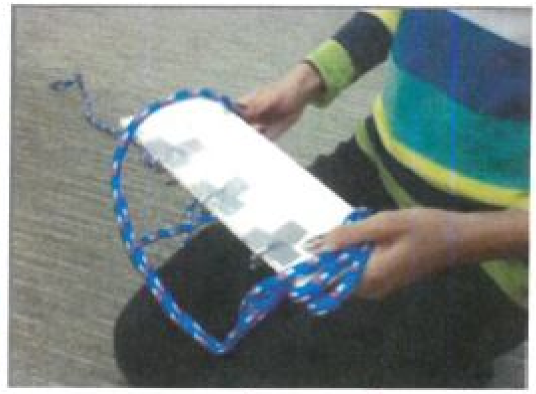

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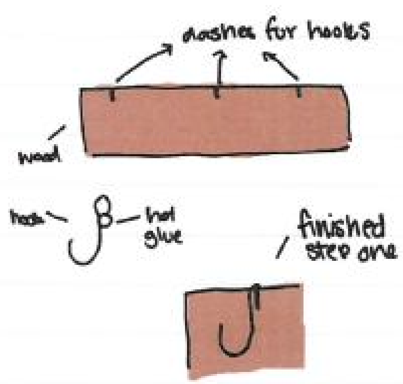

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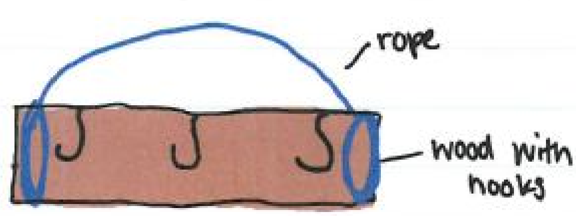

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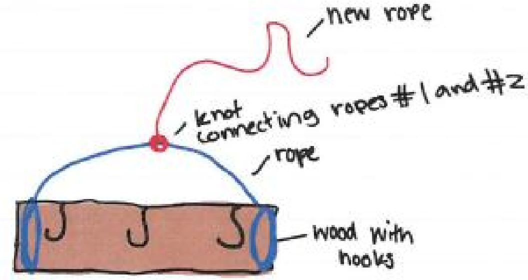
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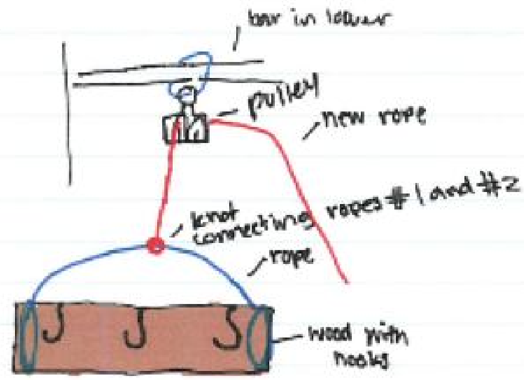
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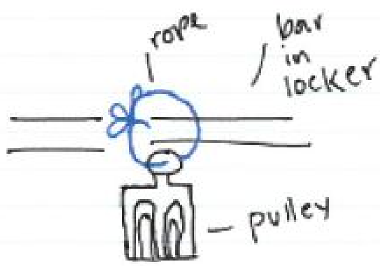
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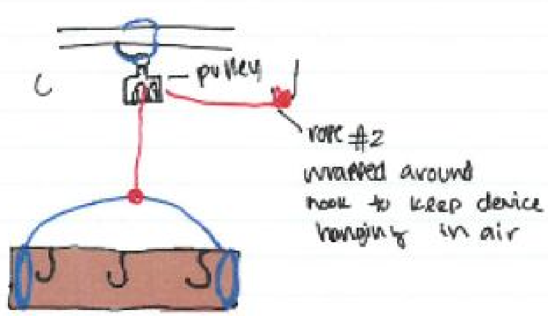
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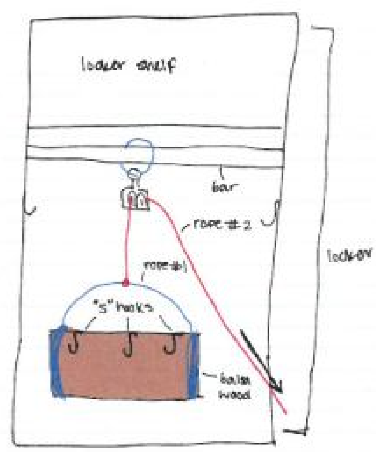
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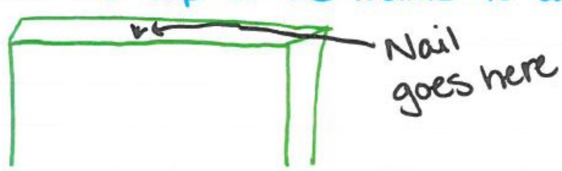

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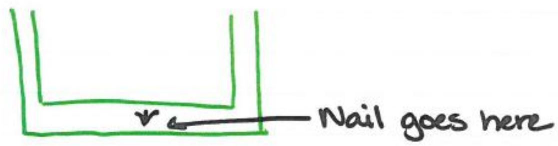

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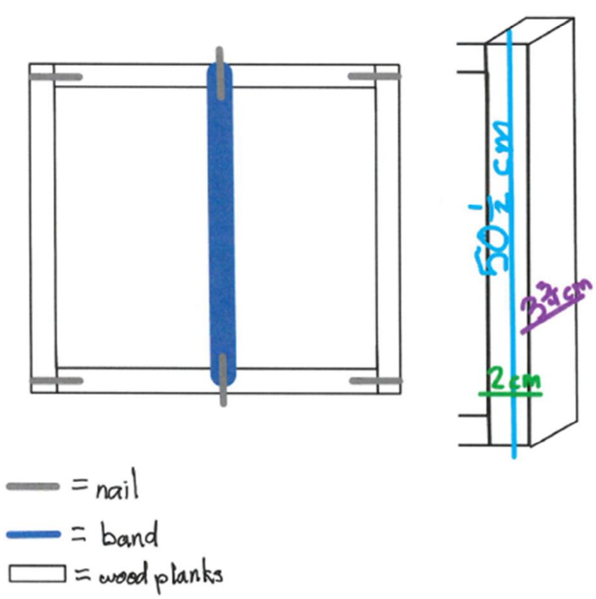

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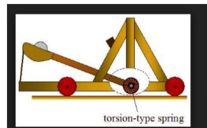

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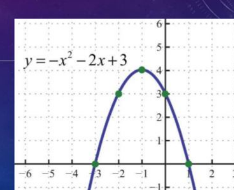

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Simple Machines Design Challenge

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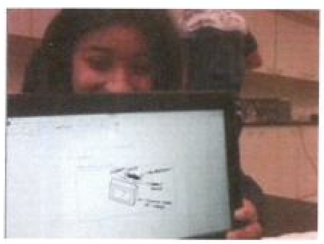

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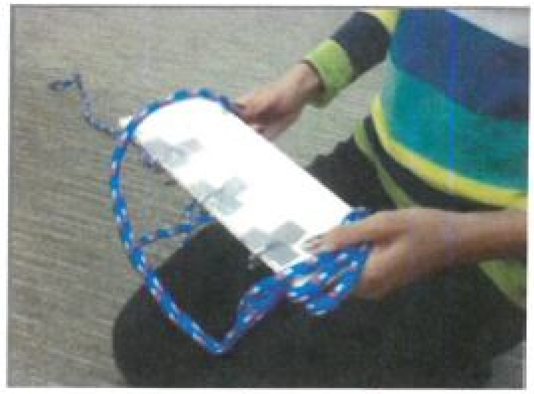

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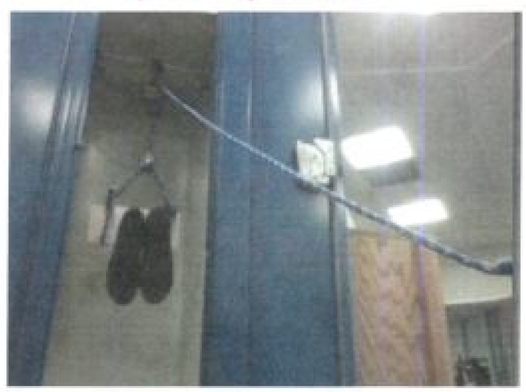

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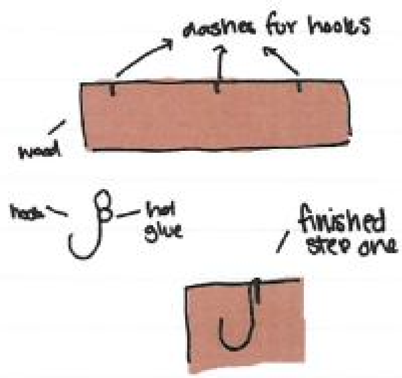

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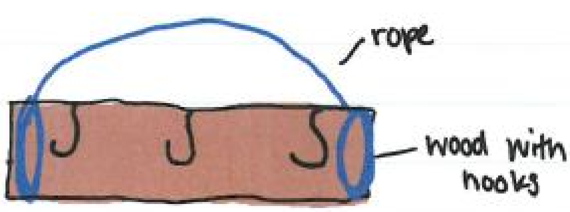

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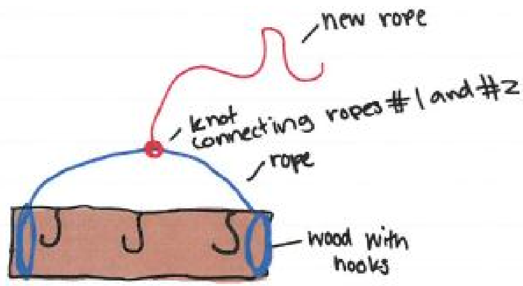
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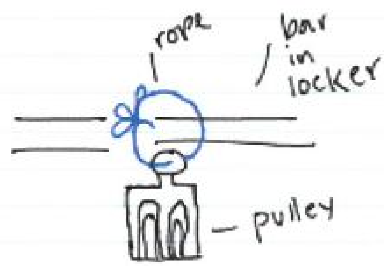
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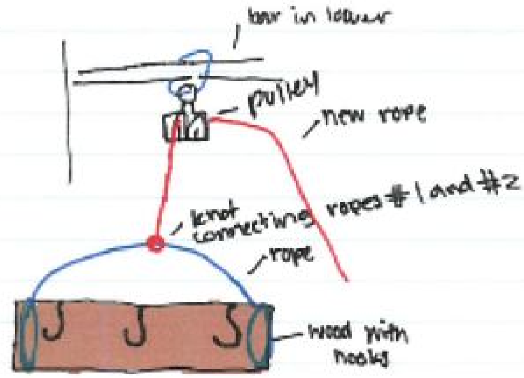
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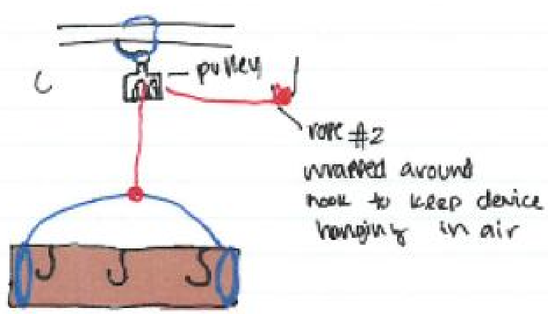
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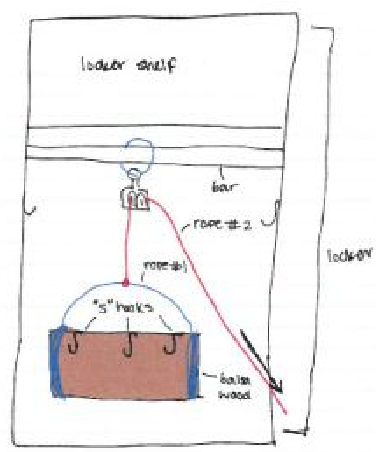
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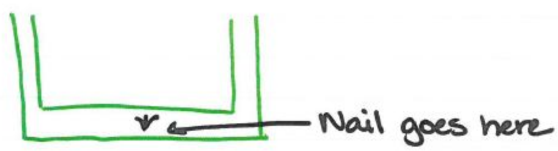

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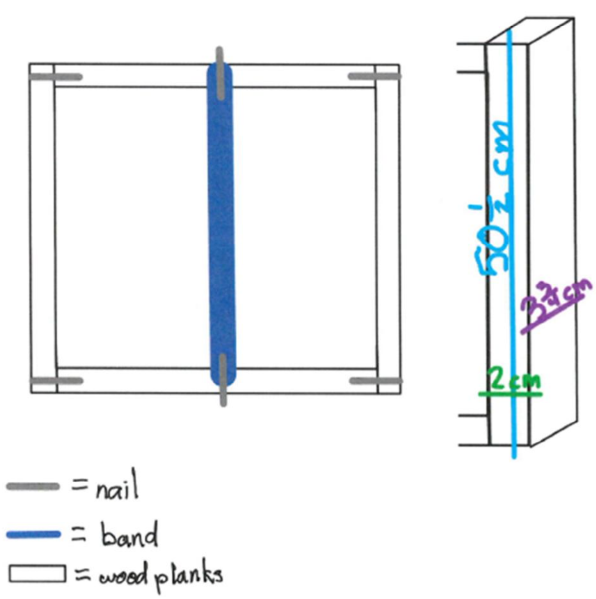

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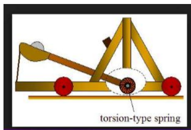

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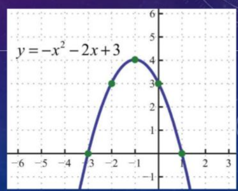

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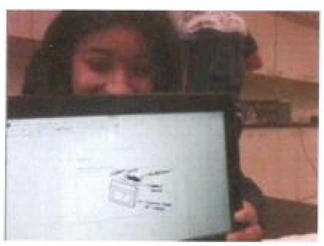

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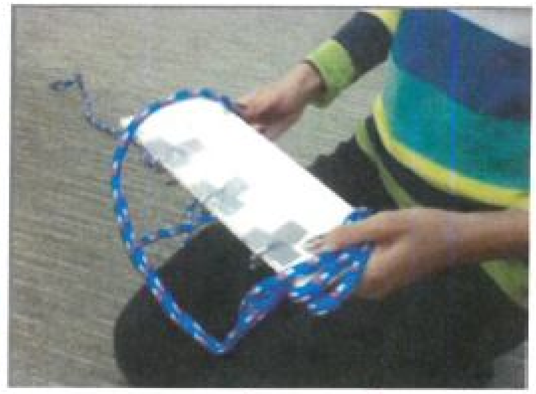

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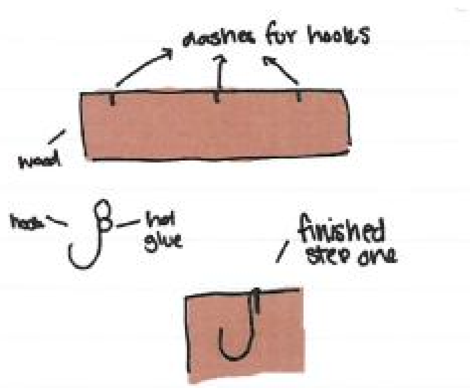

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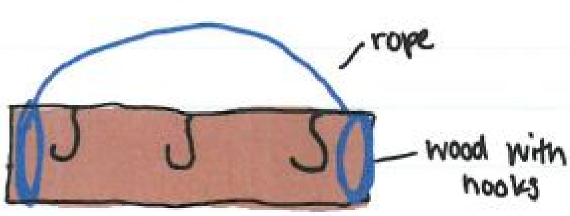

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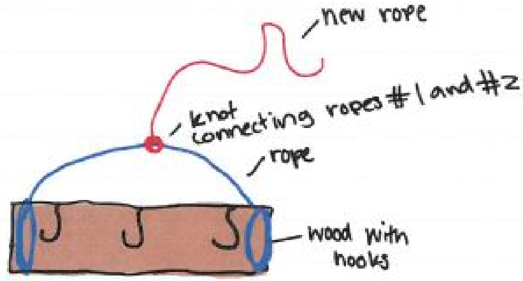
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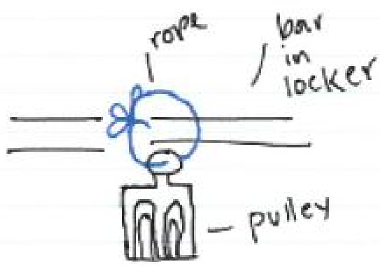
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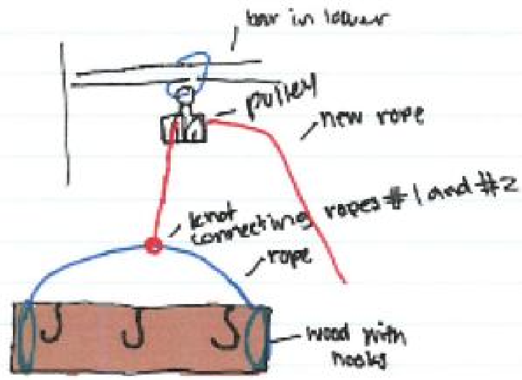
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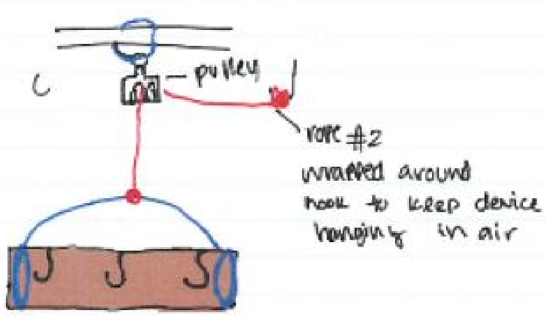
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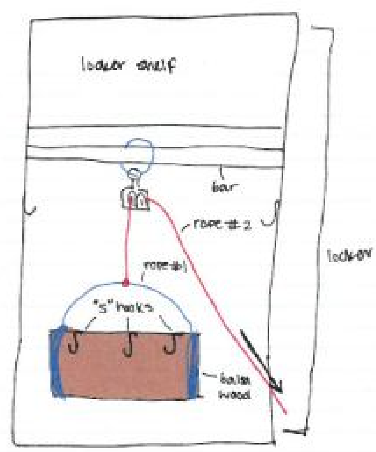
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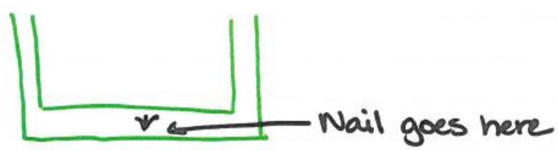

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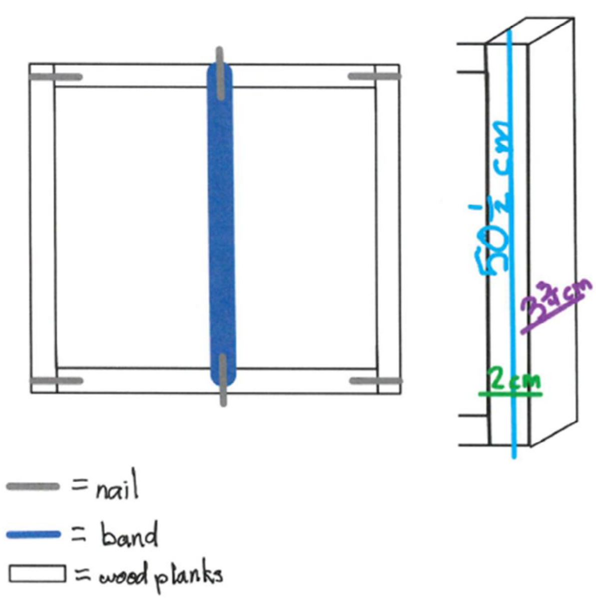

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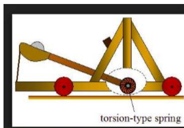
PRESENTATION

HISTORY OF THE CATAPULT

- It was used in the middles ages to help win battles and wars.
- Since castle walls were getting stronger, armies needed something that could break through them.
- Many kinds of catapults were used.
- Some are tension powered, trebuchet, torsion powered, gravity powered, and traction powered.



TENSION POWERED CATAPULT

Also a little more history

- Tension powered catapults have a long flexible arm, so that when the basket is bent backwards to give the weapon its throwing power, the arm won't break making the weapon useless in battle. The basket was tied or hooked in some way when bent backwards, so that large stones or other types of projectiles could be loaded into the basket. When the basket was released the projectile would fly into the air hopefully hitting the castle wall and causing part of it to tumble to the ground. Sometimes flaming projectiles were put in the basket. Upon impact the ball would burst setting fire to everything in a given radius. The tension powered catapult was often used for destruction of castle walls, but sometimes it was used as a defense weapon for the castle itself. The tension catapult was able to throw and shoot farther than most other types. It was also a better weapon than the ballista, as the catapult was portable with it's wheels.

HISTORY OF THE SLINGSHOT

- Is a small hand-powered projectile weapon.
- Was invented after the invention of elastic/rubber.
- Late 1800s

SLINGSHOTS IN CLEVELAND

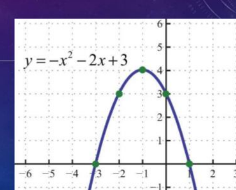
Slingshots are not used often, but when they are they are manly used for hunting and entertainment. Slingshots are used to hunt anywhere from small to large game. These include anywhere from squirrels and rabbits to large dear. Hunters could have used these while hunting.

PROJECTILE MOTION

- Projectile motion is a form of motion in which an object or particle (called a projectile) is thrown near the earth's surface, and it moves along a curved path under the action of gravity only. The only force of significance that acts on the object is gravity, which acts downward to cause a downward acceleration. Because of the object's inertia, no external horizontal force is needed to maintain the horizontal motion.
- Projectile motion is used in Cleveland in most sports games. For example, a baseball follows a parabola.

MATH CONCEPTS

The equation ax^2+bx+c is the equation of a parabola. This is the form of the equation that you will make using the iPads.



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Simple Machines Design Challenge

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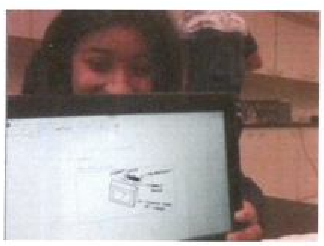

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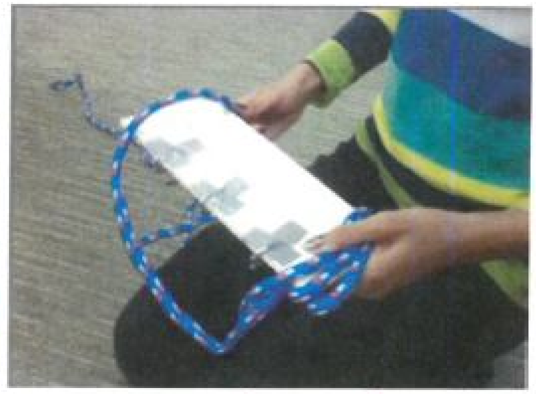

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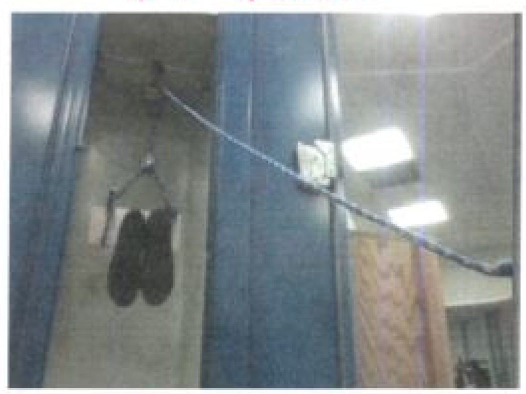

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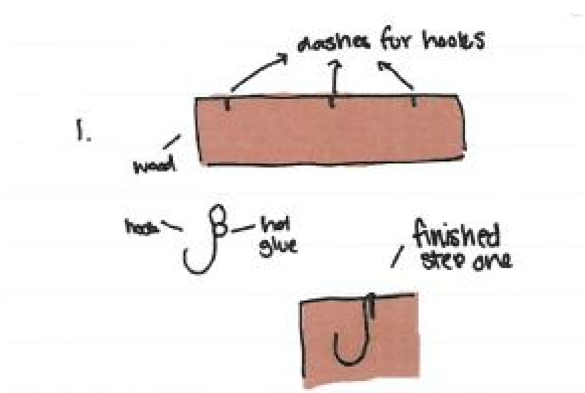

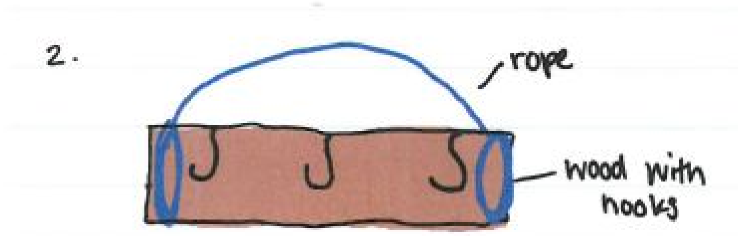

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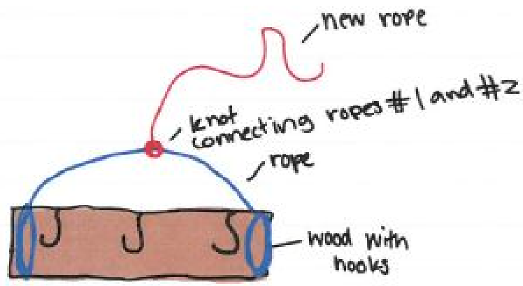

new rope
knot connecting ropes #1 and #2
rope
wood with hooks

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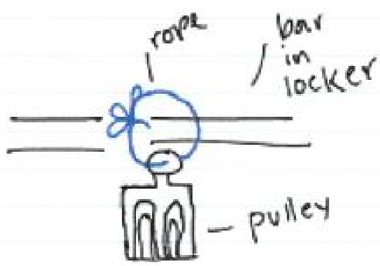

rope
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pulley

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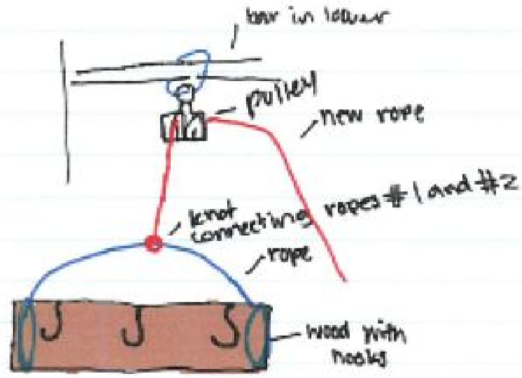

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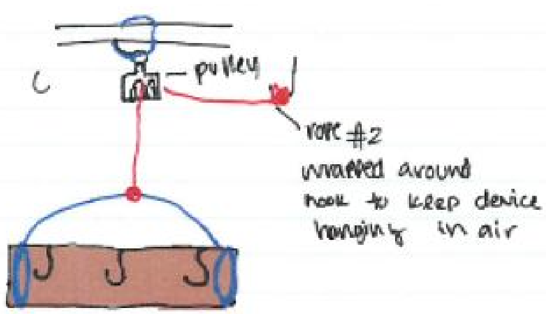

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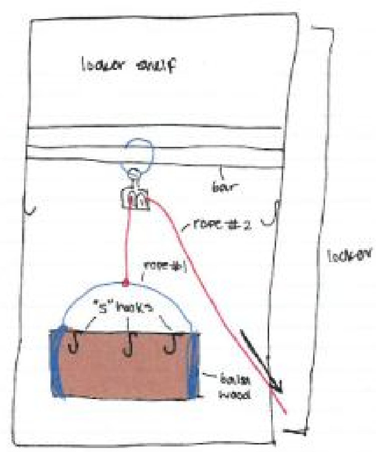

locker shelf
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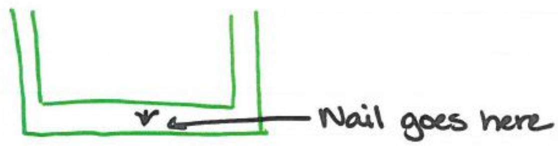

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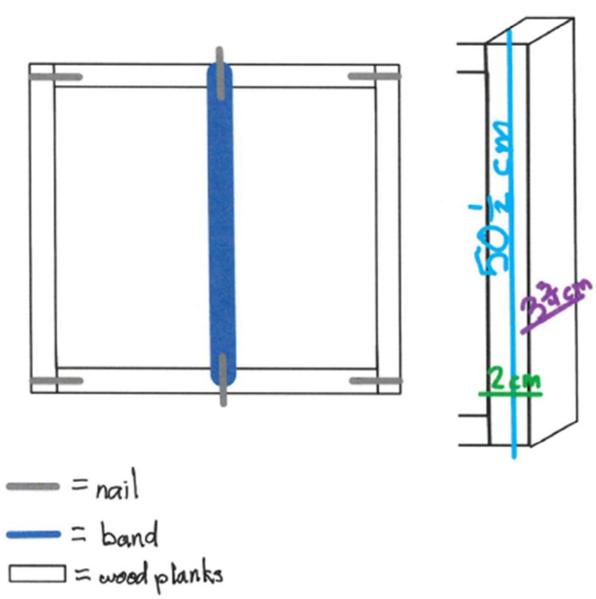

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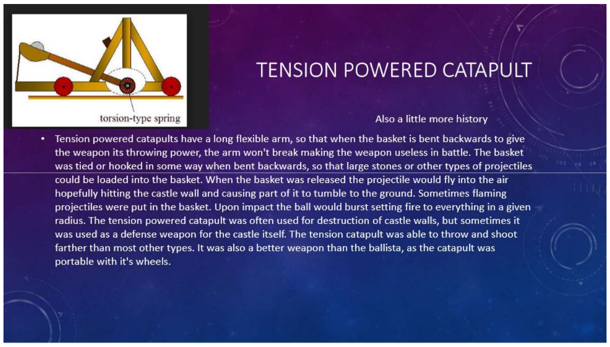

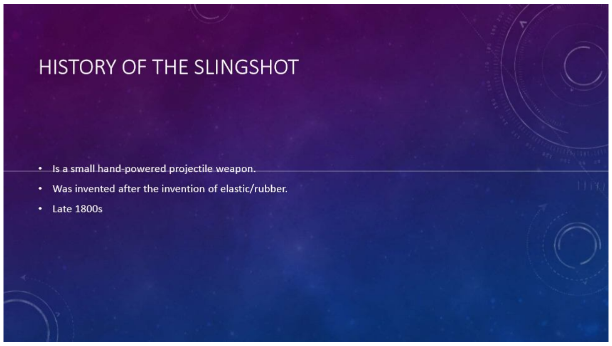

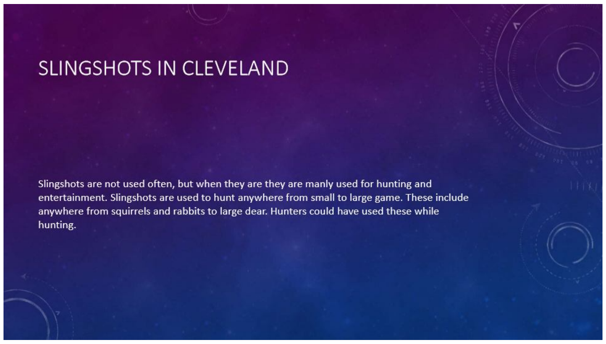

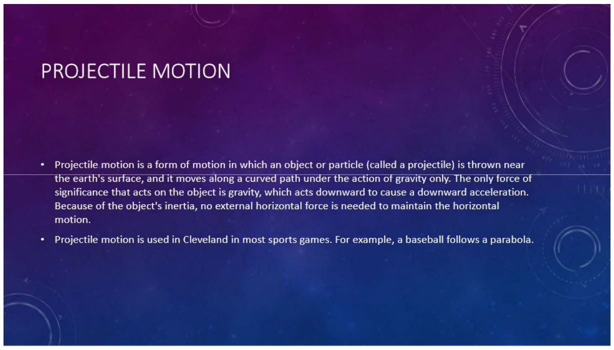

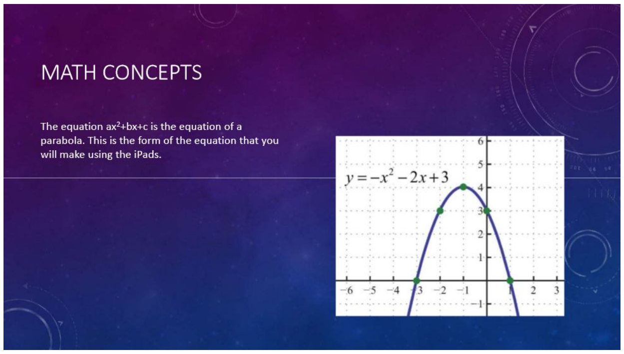

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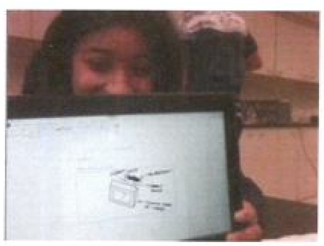

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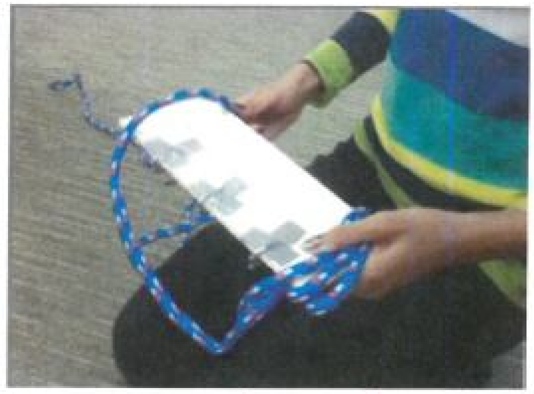

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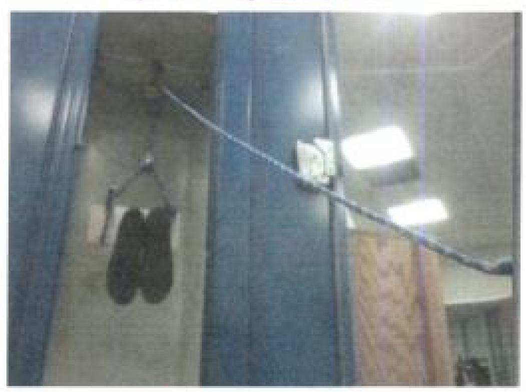

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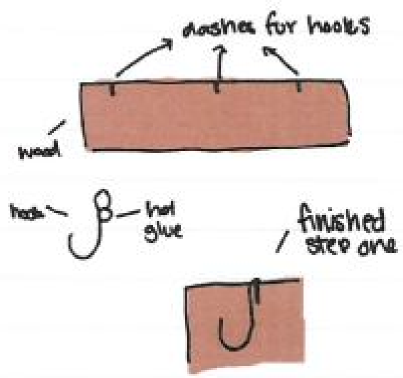

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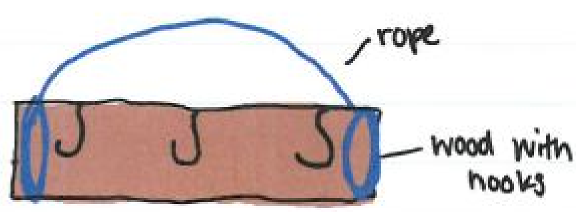

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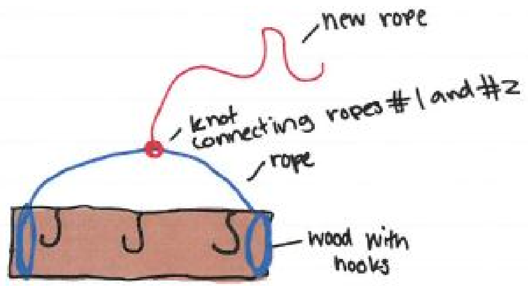
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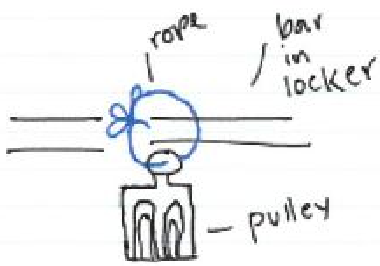
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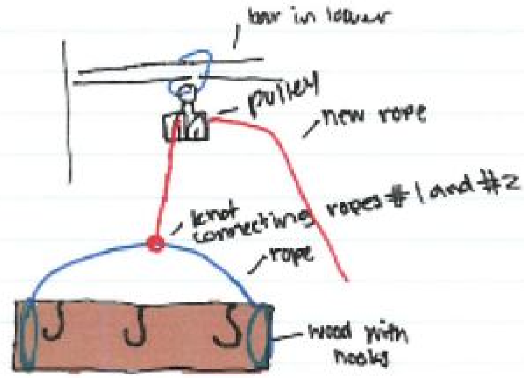
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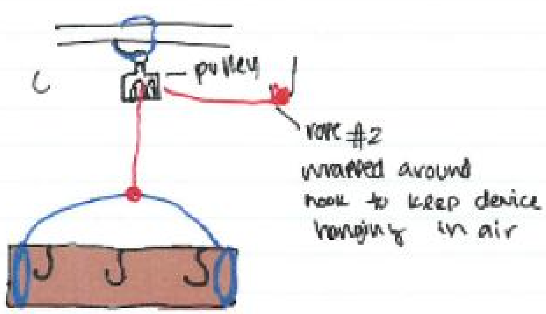
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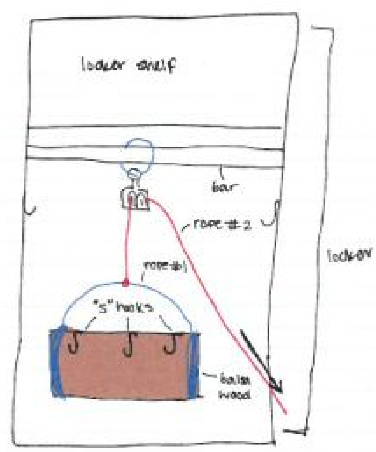
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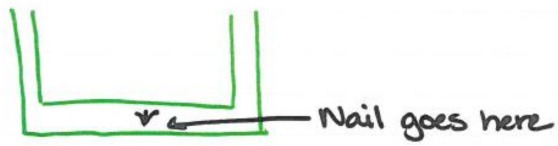

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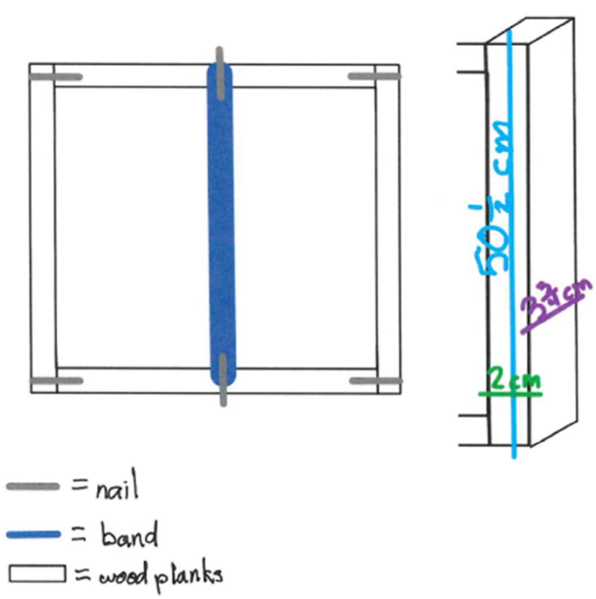

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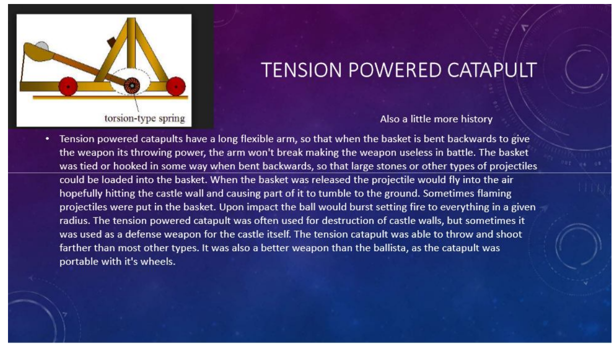

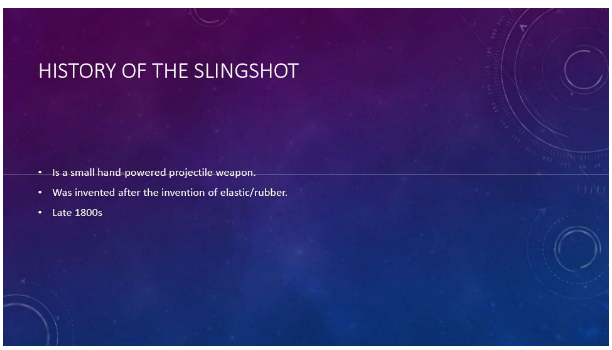

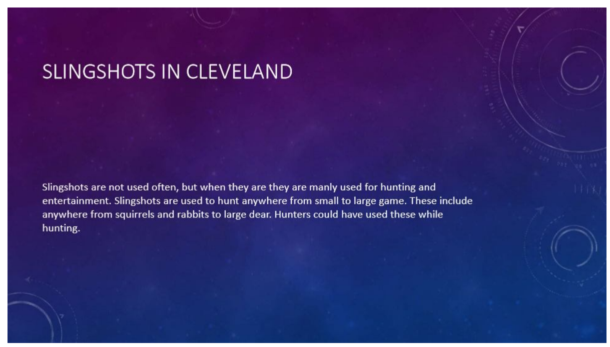

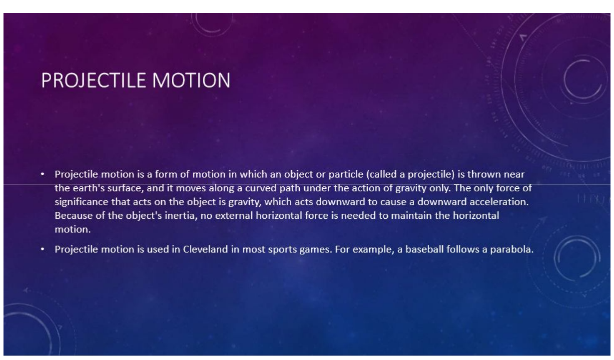

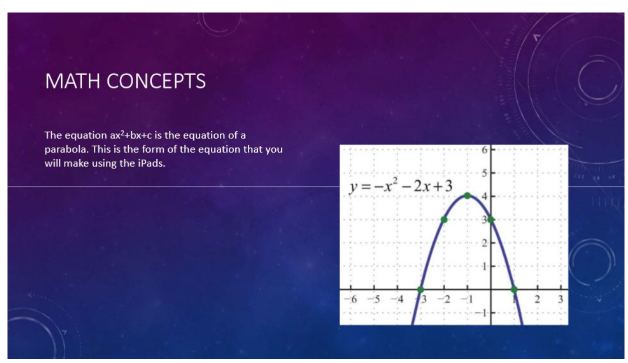

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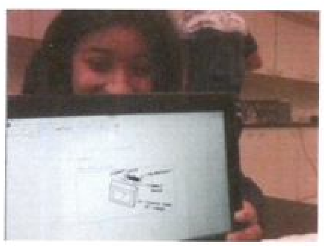

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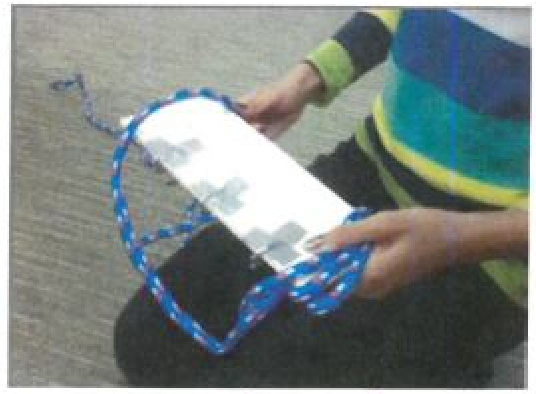

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1 of the screwable rectangles			1	
leather band			1	
			TOTAL COST:	

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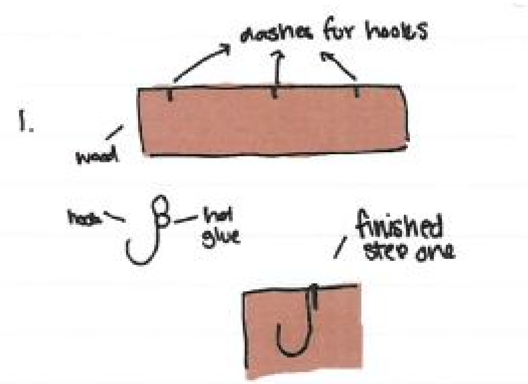

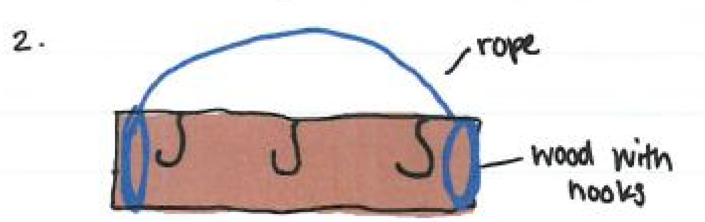

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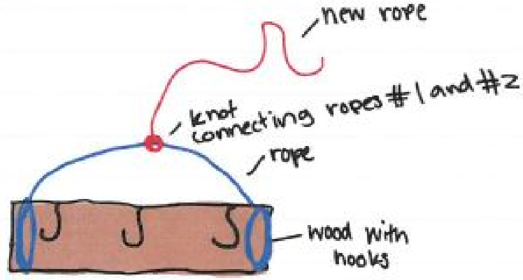
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knot connecting ropes #1 and #2
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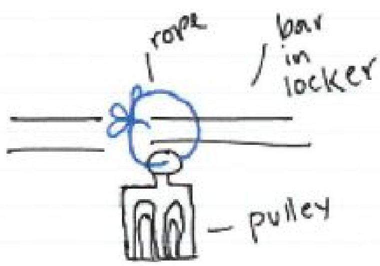
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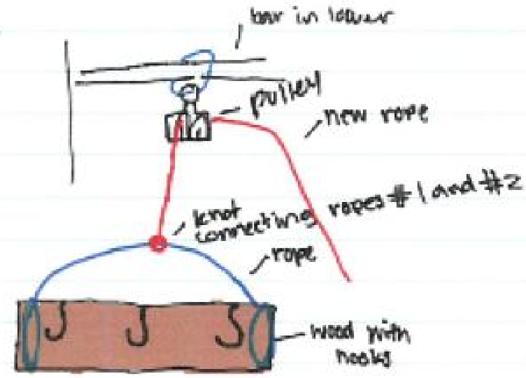
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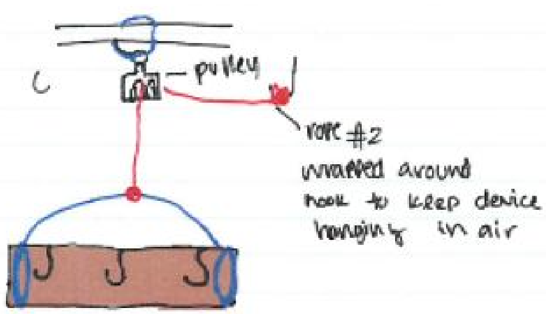
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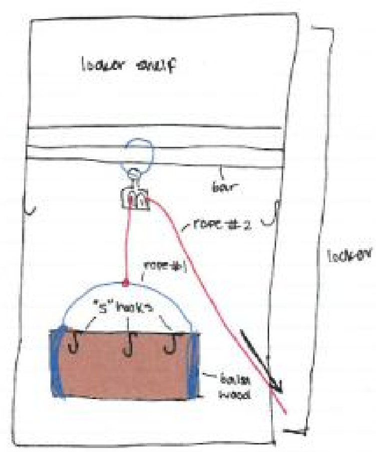
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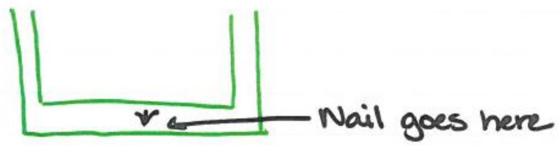

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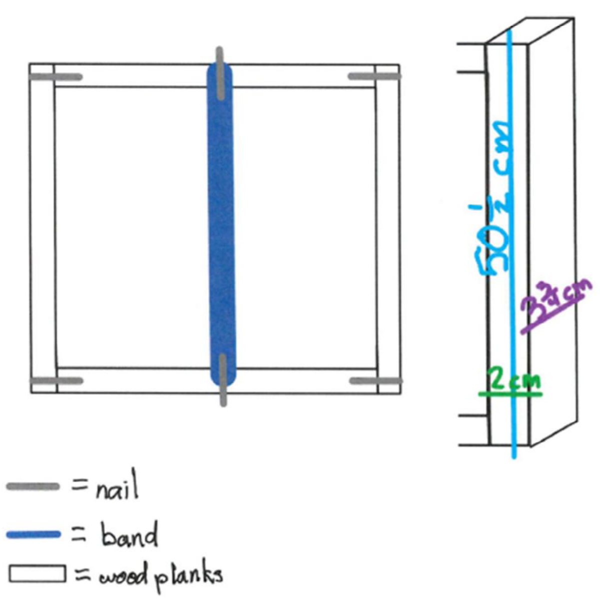

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PART 3: CONSTRUCTION + DATA COLLECTION

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Distance Dart will be dropped from: 1 m

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!!!!! This is the distance away from your firer you should place your target!

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- It was used in the middles ages to help win battles and wars.
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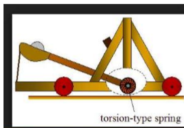

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- Tension powered catapults have a long flexible arm, so that when the basket is bent backwards to give the weapon its throwing power, the arm won't break making the weapon useless in battle. The basket was tied or hooked in some way when bent backwards, so that large stones or other types of projectiles could be loaded into the basket. When the basket was released the projectile would fly into the air hopefully hitting the castle wall and causing part of it to tumble to the ground. Sometimes flaming projectiles were put in the basket. Upon impact the ball would burst setting fire to everything in a given radius. The tension powered catapult was often used for destruction of castle walls, but sometimes it was used as a defense weapon for the castle itself. The tension catapult was able to throw and shoot farther than most other types. It was also a better weapon than the ballista, as the catapult was portable with it's wheels.

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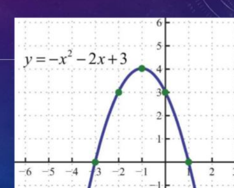
The equation ax^2+bx+c is the equation of a parabola. This is the form of the equation that you will make using the iPads.



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Simple Machines Design Challenge

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In this step, we came up with the general idea of our catapult, the jobs, and organized our thoughts.

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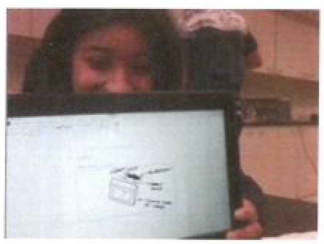

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A locker that was used for reference during the brainstorm process to put our ideas to scale.

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The website our group used to research what supplies we could use.

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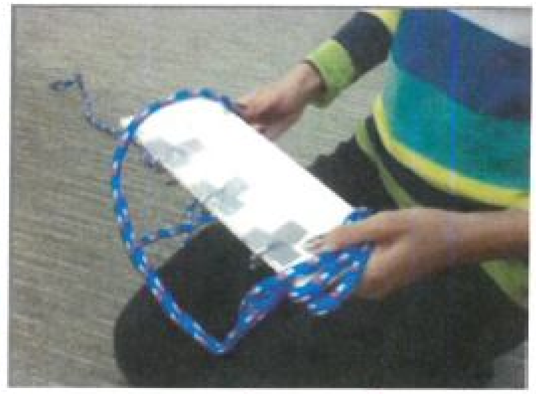

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This is the construction of the wooden frame

Us measuring and seeing where to place the elastic band.

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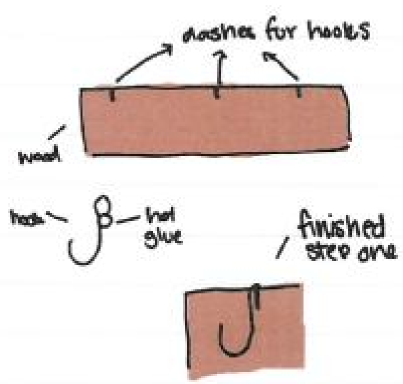

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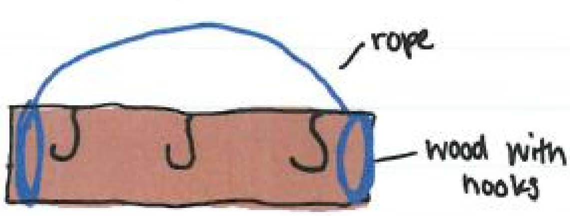

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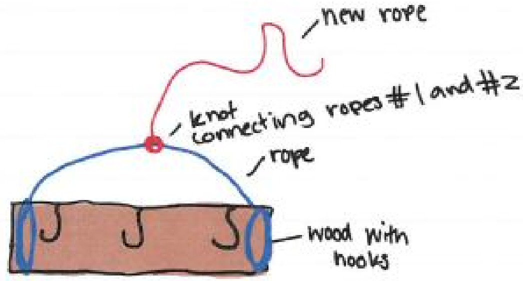
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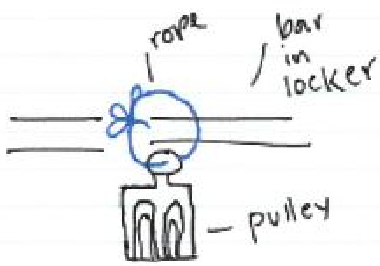
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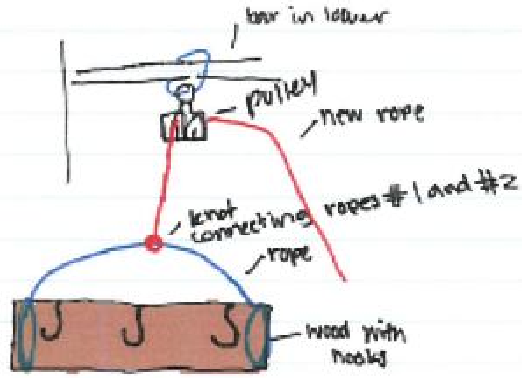
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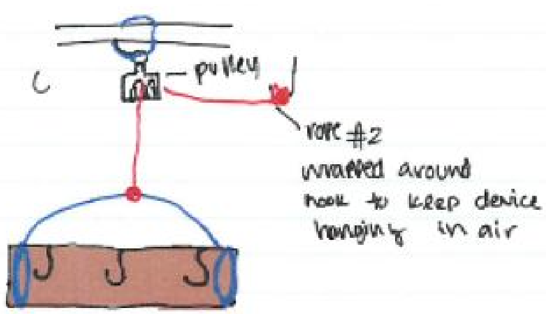
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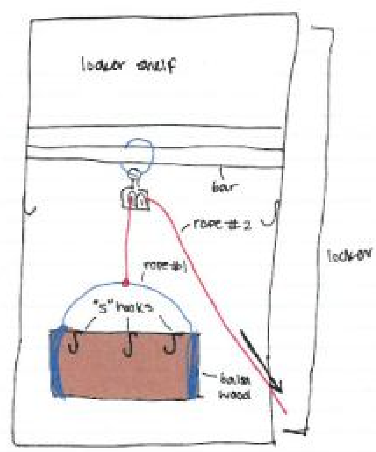
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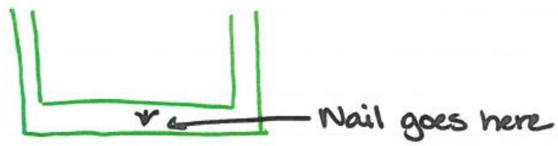

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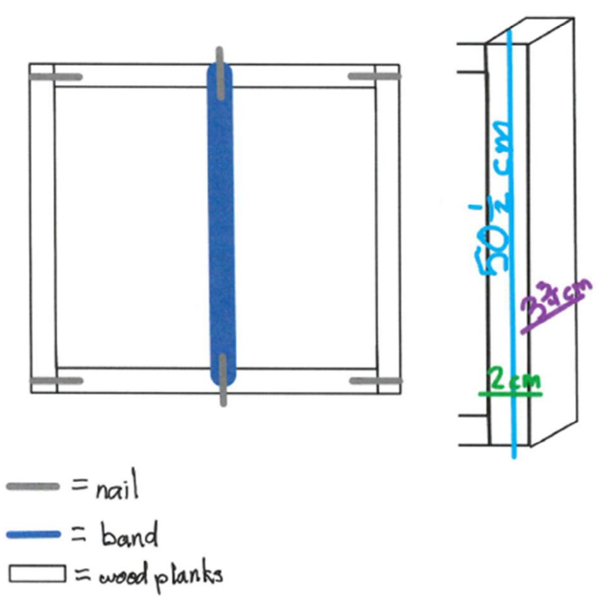

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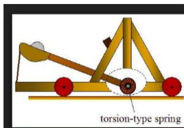

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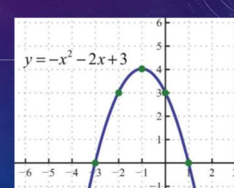

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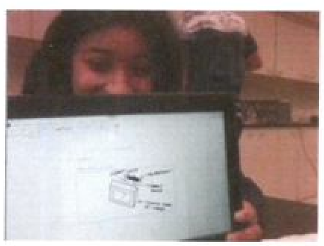

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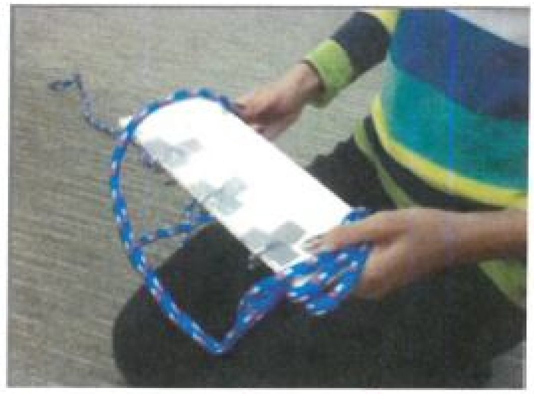

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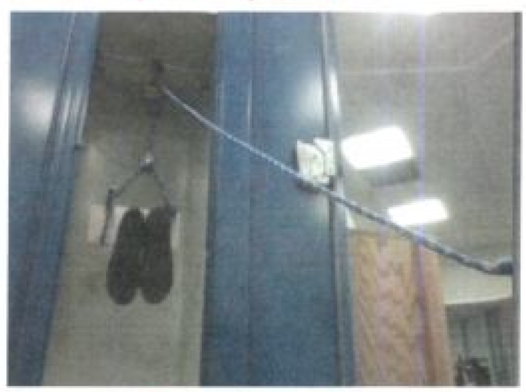

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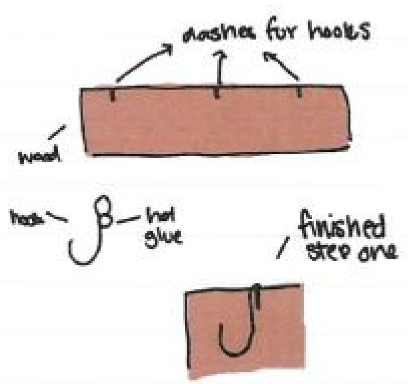

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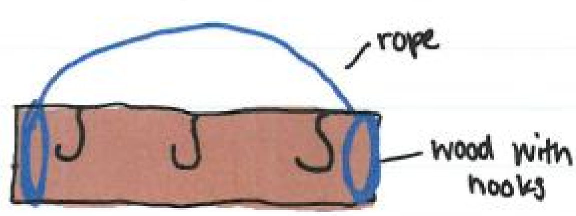

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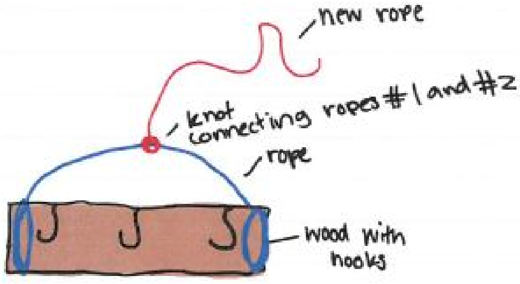
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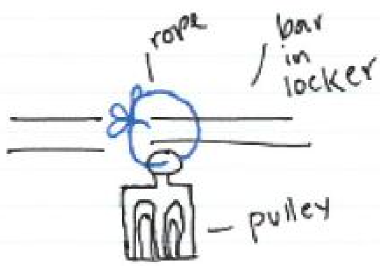
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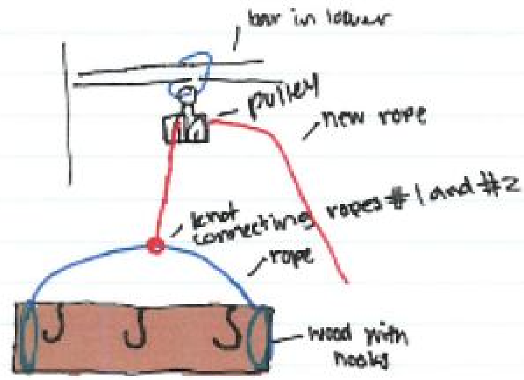
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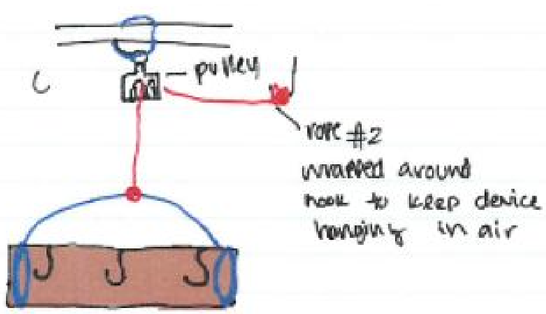
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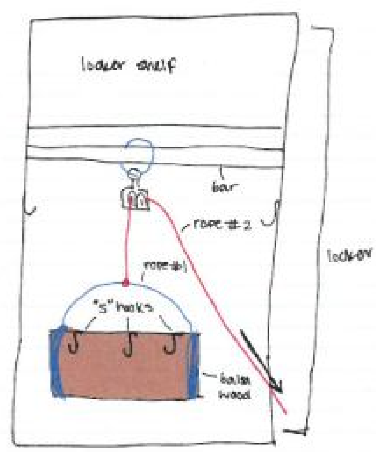
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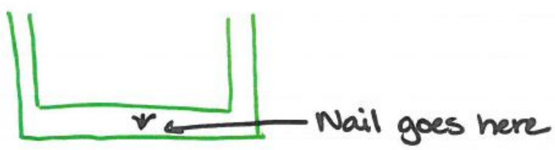

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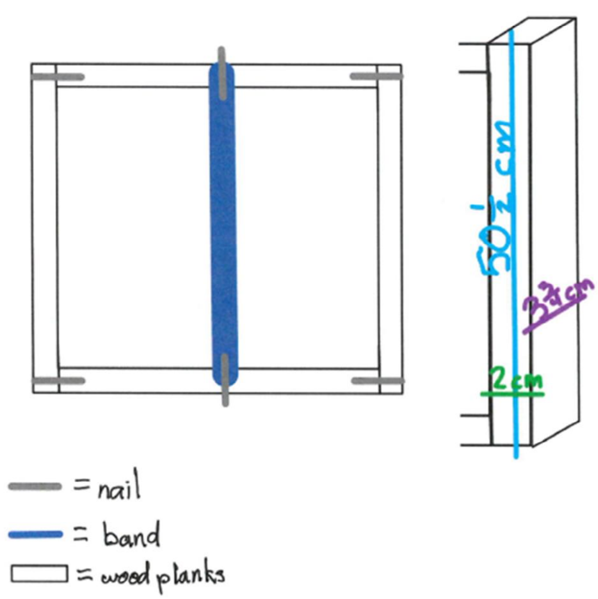

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PART 3: CONSTRUCTION + DATA COLLECTION

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Task to complete ~

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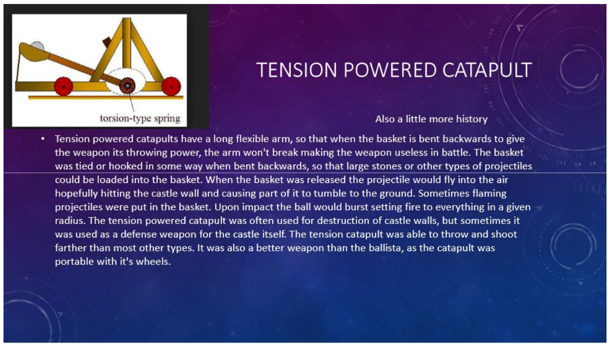

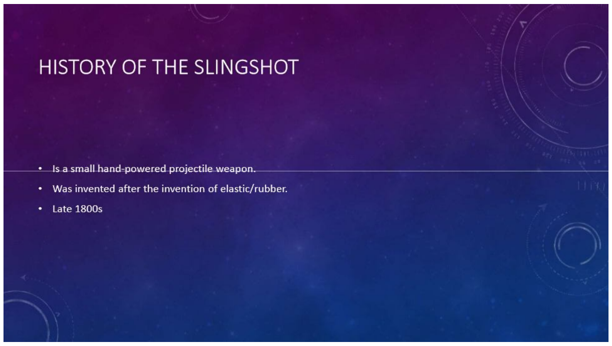

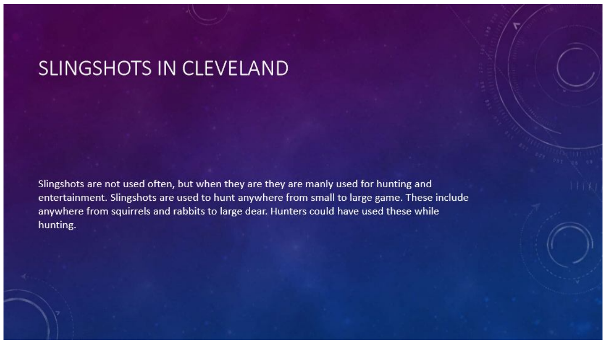

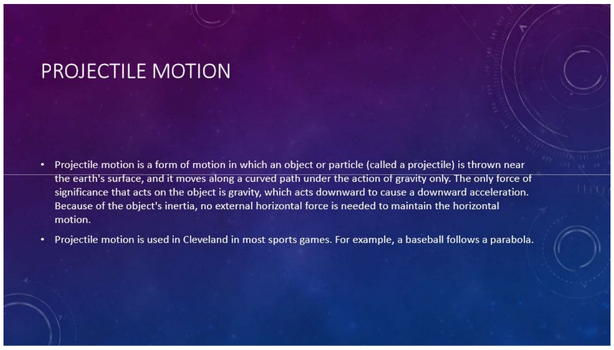

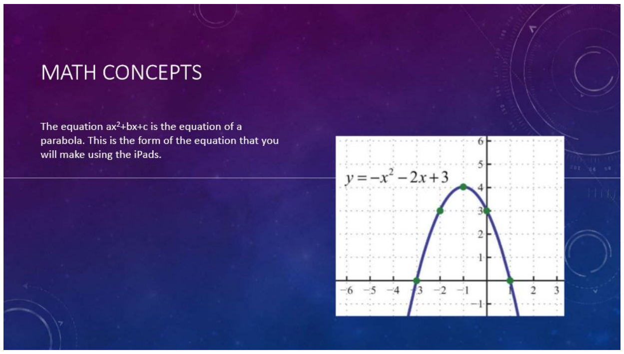

STUDENT EXAMPLES OF PROJECT COMPONENTS

Simple Machines Design Challenge

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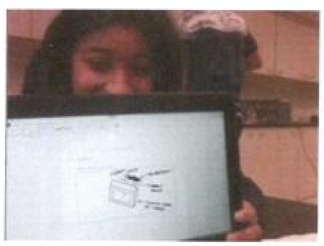

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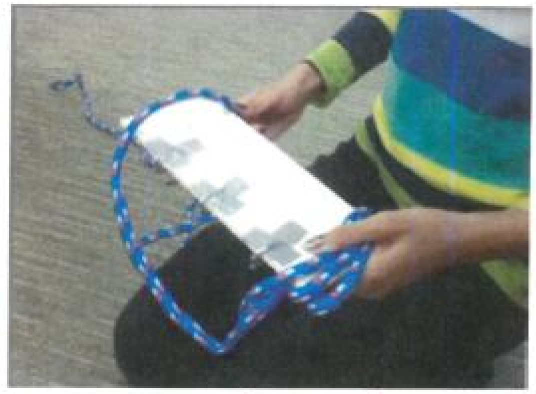

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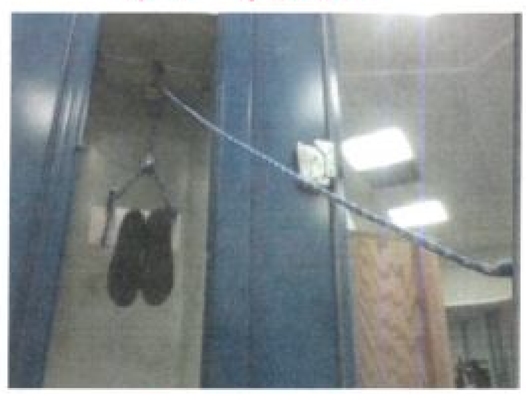

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This is the construction of the wooden frame

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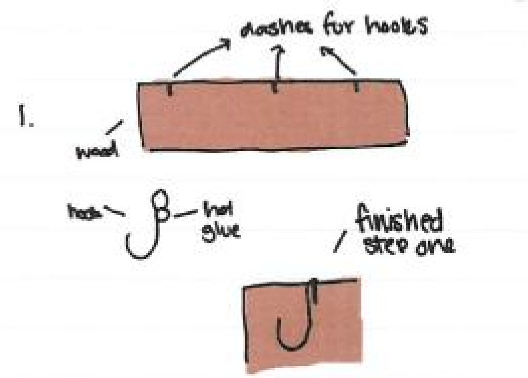

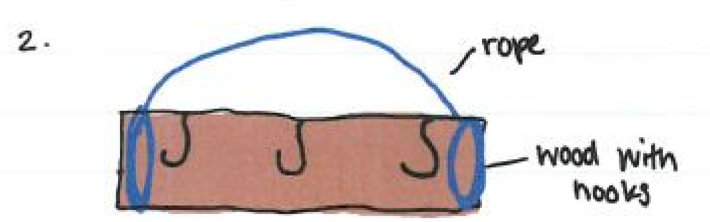

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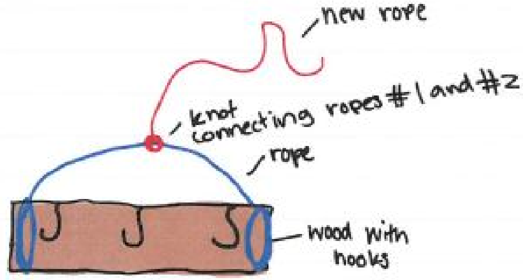
new rope
knot connecting ropes #1 and #2
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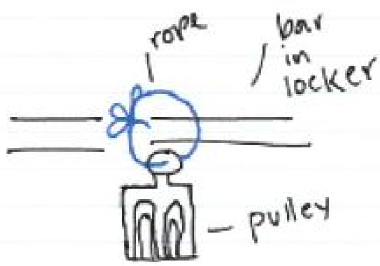
rope
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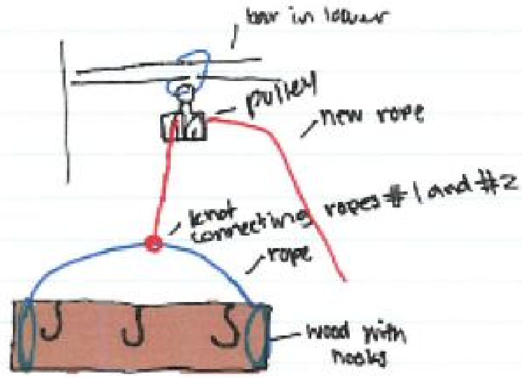
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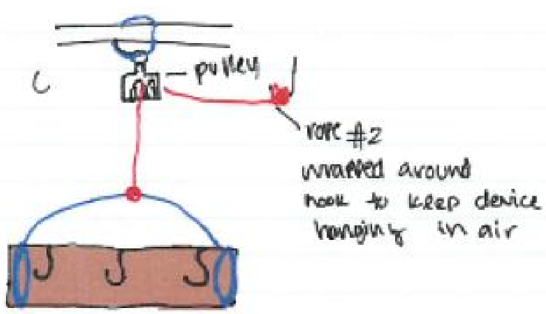
pulley
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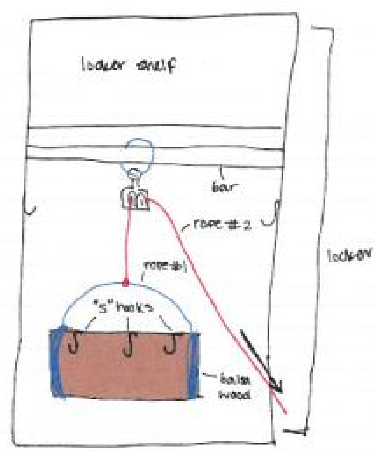
wrapped around hook to keep device hanging in air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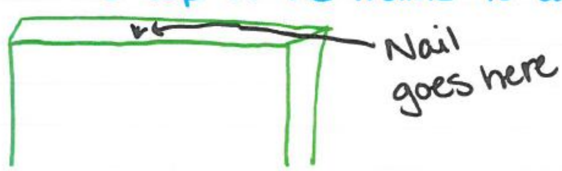

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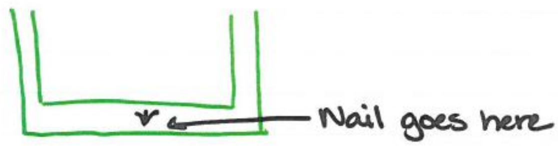

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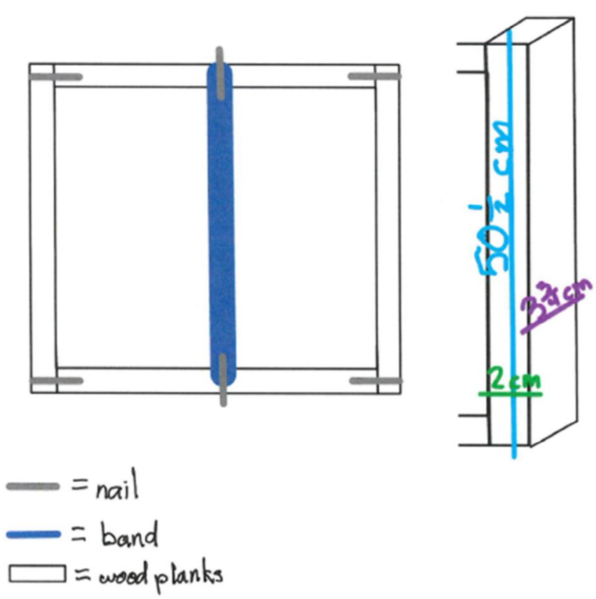

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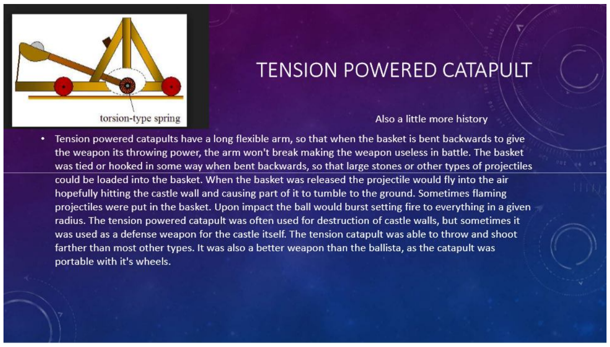

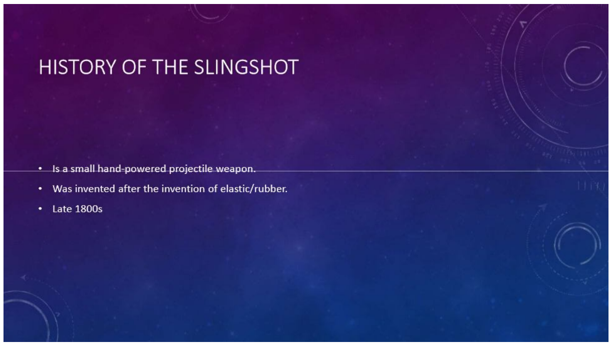

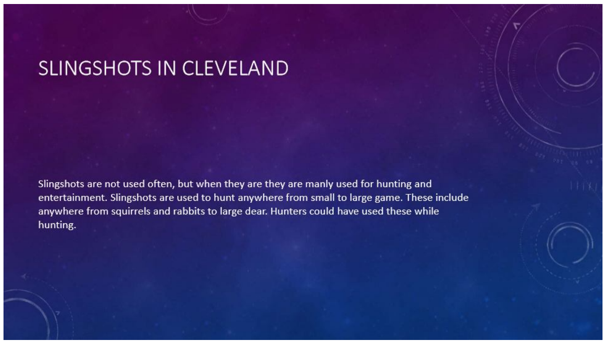

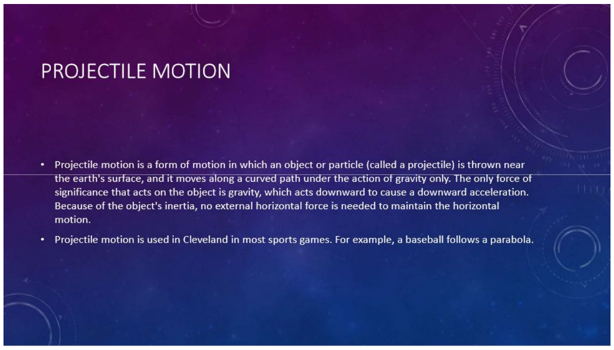

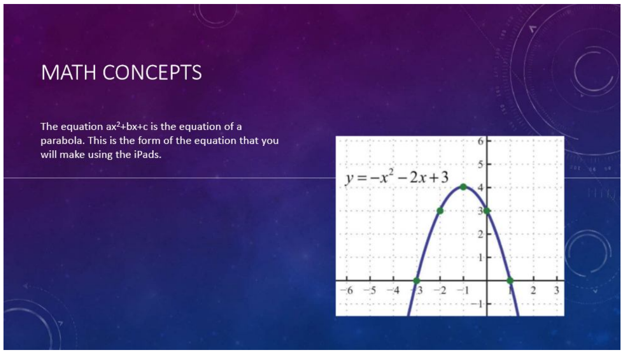

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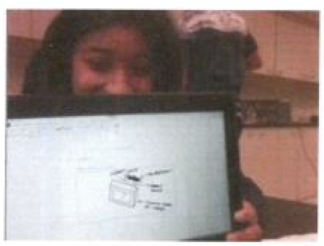

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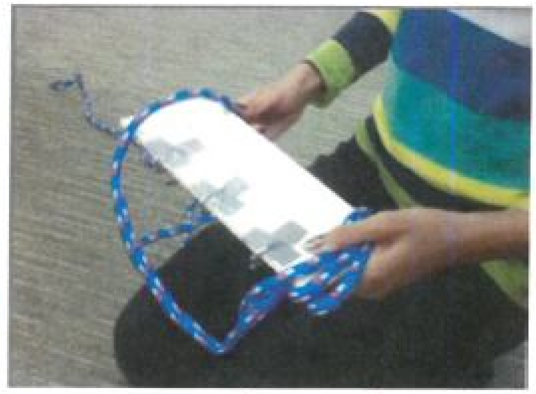

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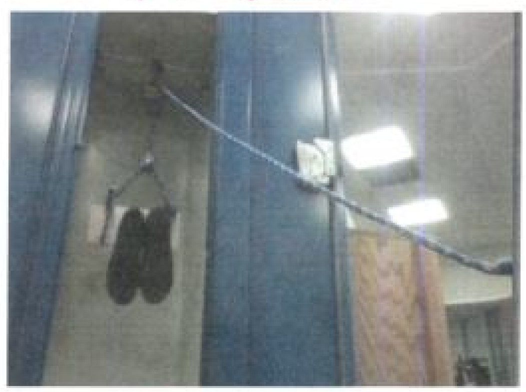

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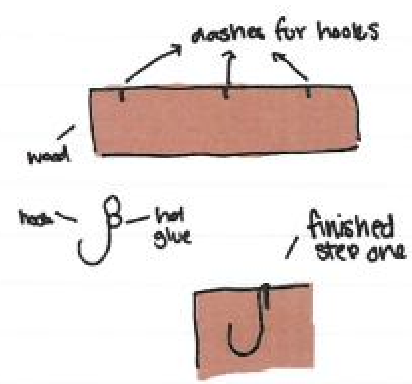

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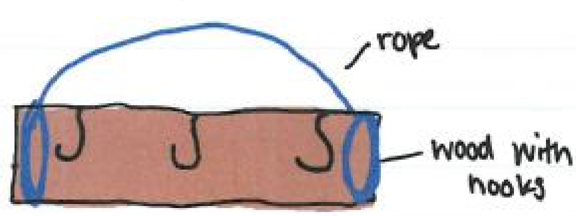

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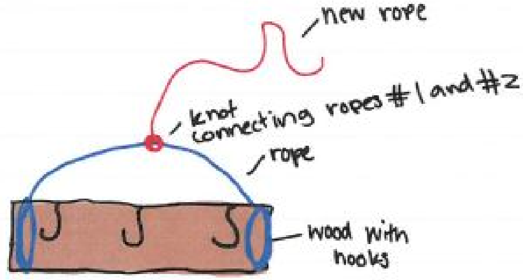
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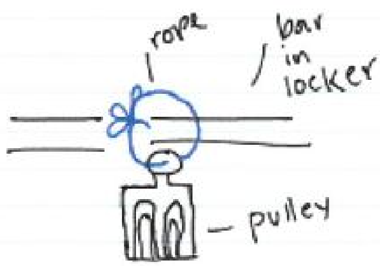
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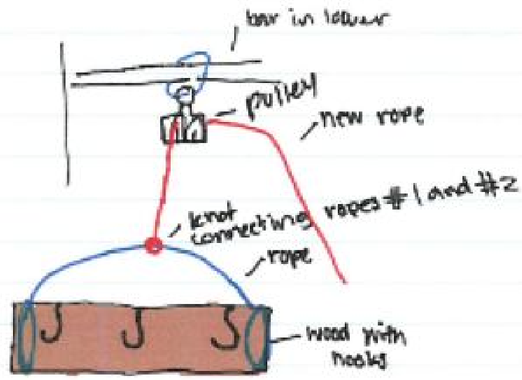
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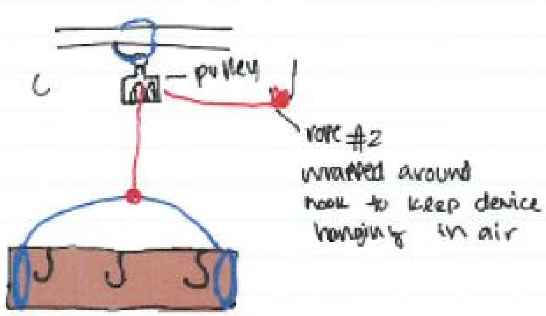
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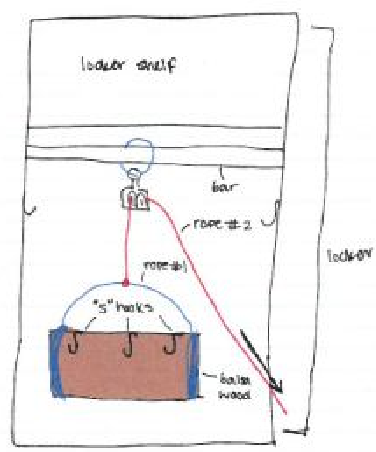
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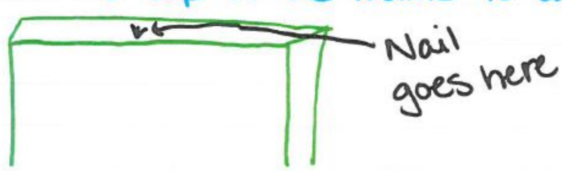

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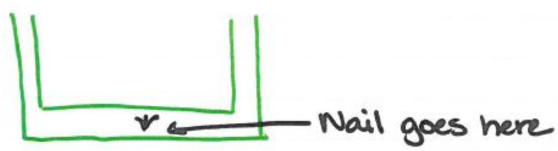

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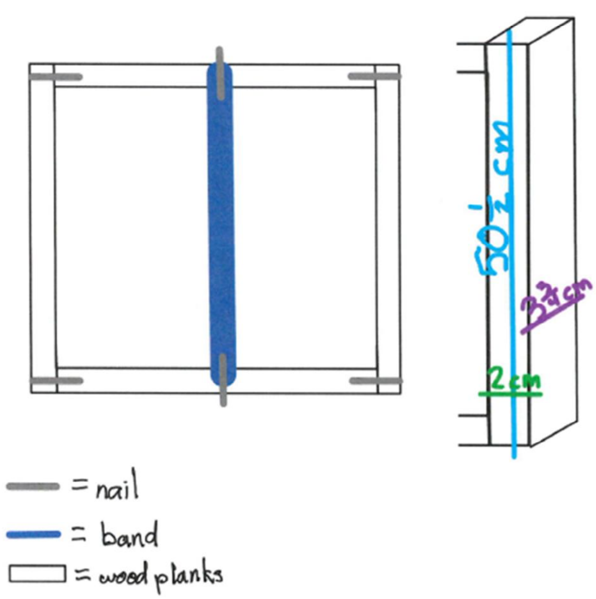

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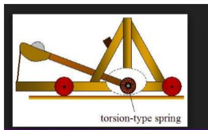
PRESENTATION

HISTORY OF THE CATAPULT

- It was used in the middles ages to help win battles and wars.
- Since castle walls were getting stronger, armies needed something that could break through them.
- Many kinds of catapults were used.
- Some are tension powered, trebuchet, torsion powered, gravity powered, and traction powered.



TENSION POWERED CATAPULT

Also a little more history

- Tension powered catapults have a long flexible arm, so that when the basket is bent backwards to give the weapon its throwing power, the arm won't break making the weapon useless in battle. The basket was tied or hooked in some way when bent backwards, so that large stones or other types of projectiles could be loaded into the basket. When the basket was released the projectile would fly into the air hopefully hitting the castle wall and causing part of it to tumble to the ground. Sometimes flaming projectiles were put in the basket. Upon impact the ball would burst setting fire to everything in a given radius. The tension powered catapult was often used for destruction of castle walls, but sometimes it was used as a defense weapon for the castle itself. The tension catapult was able to throw and shoot farther than most other types. It was also a better weapon than the ballista, as the catapult was portable with it's wheels.

HISTORY OF THE SLINGSHOT

- Is a small hand-powered projectile weapon.
- Was invented after the invention of elastic/rubber.
- Late 1800s

SLINGSHOTS IN CLEVELAND

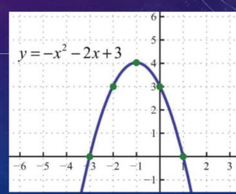
Slingshots are not used often, but when they are they are manly used for hunting and entertainment. Slingshots are used to hunt anywhere from small to large game. These include anywhere from squirrels and rabbits to large dear. Hunters could have used these while hunting.

PROJECTILE MOTION

- Projectile motion is a form of motion in which an object or particle (called a projectile) is thrown near the earth's surface, and it moves along a curved path under the action of gravity only. The only force of significance that acts on the object is gravity, which acts downward to cause a downward acceleration. Because of the object's inertia, no external horizontal force is needed to maintain the horizontal motion.
- Projectile motion is used in Cleveland in most sports games. For example, a baseball follows a parabola.

MATH CONCEPTS

The equation ax^2+bx+c is the equation of a parabola. This is the form of the equation that you will make using the iPads.



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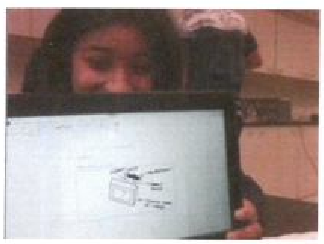

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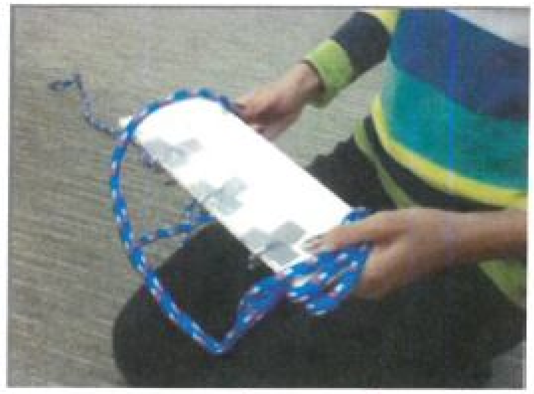

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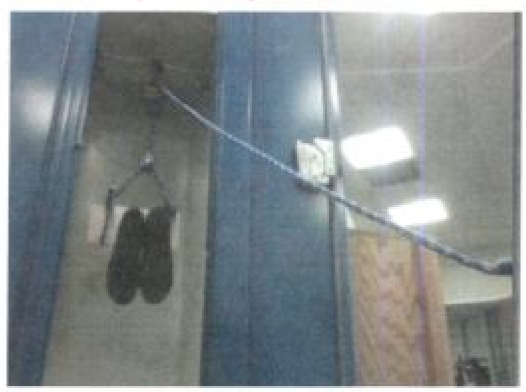

4th - data collection

This is the construction of the wooden frame

This is the frame and us attaching the elastic band to the frame with nails.

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1 of the screwable rectangles ✓			1	
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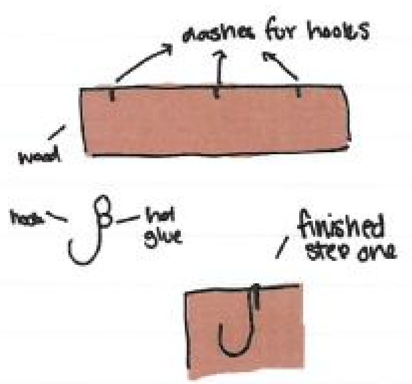

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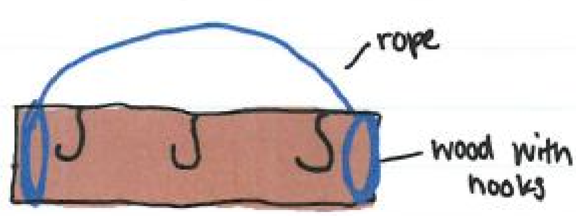

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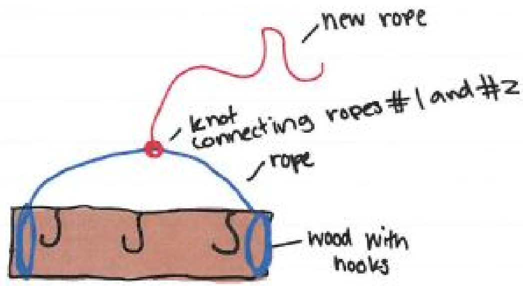
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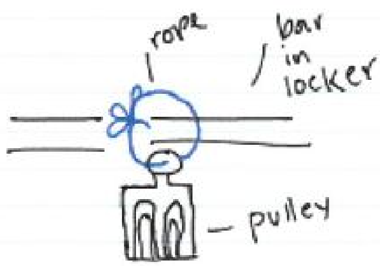
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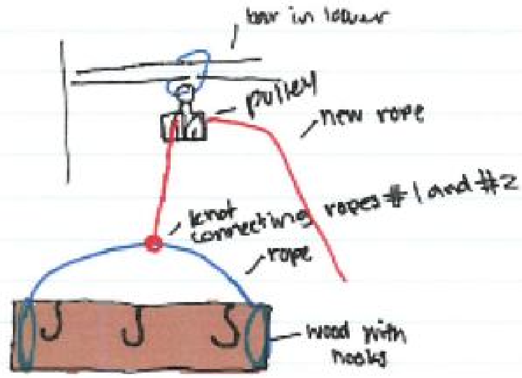
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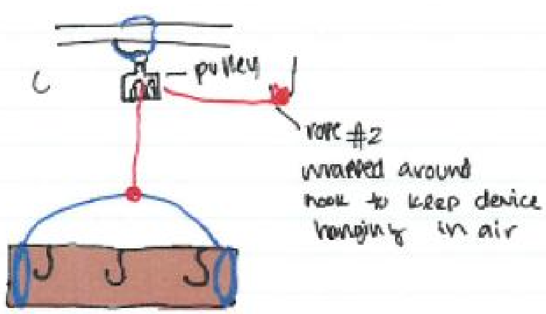
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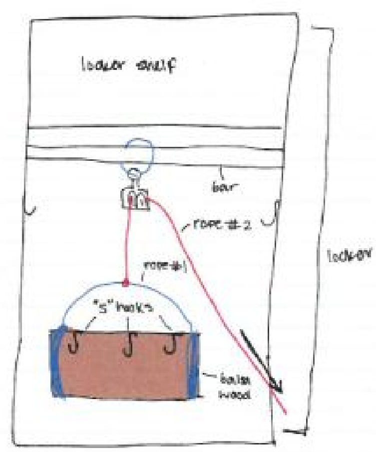
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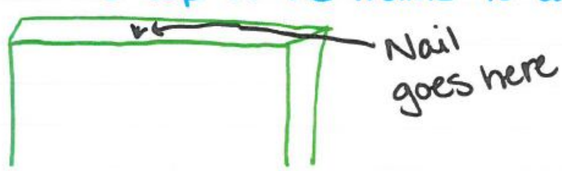

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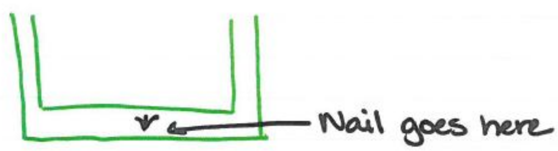

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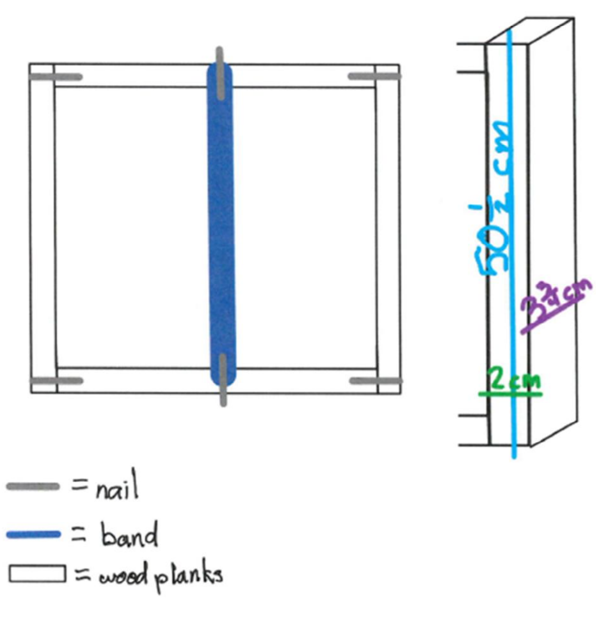

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Type of machine constructed ~

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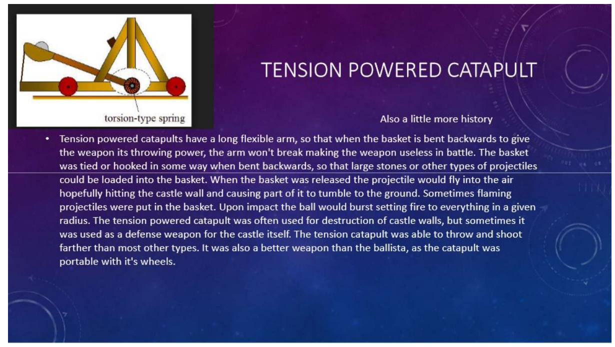

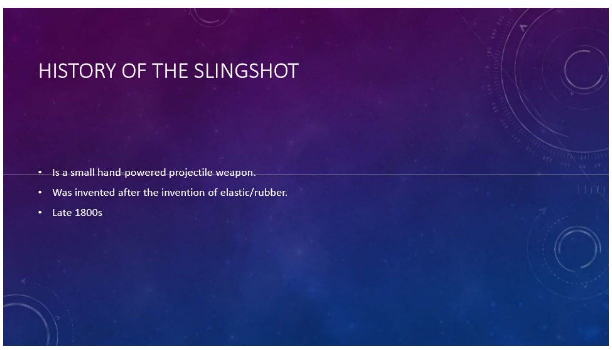

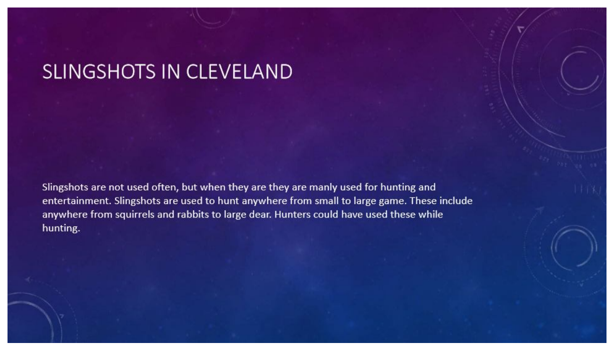

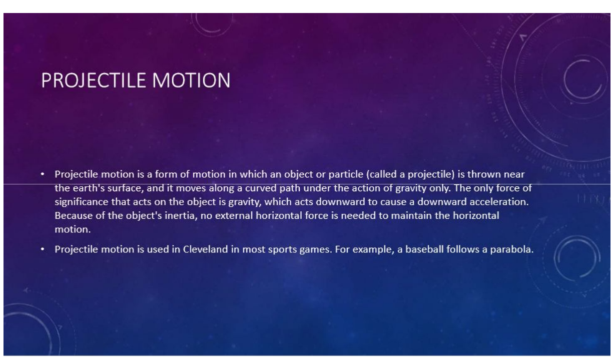

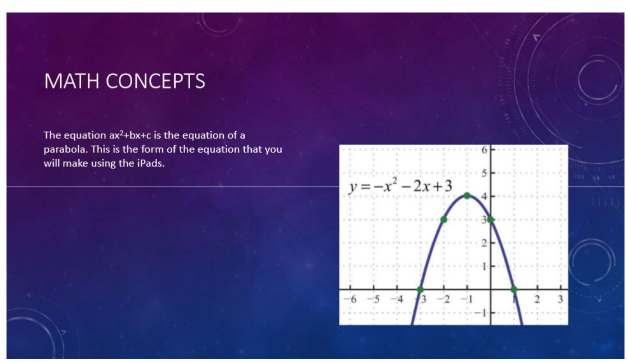

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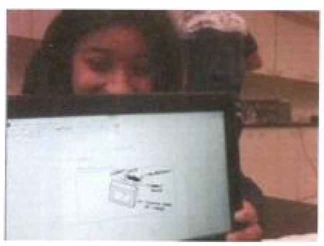

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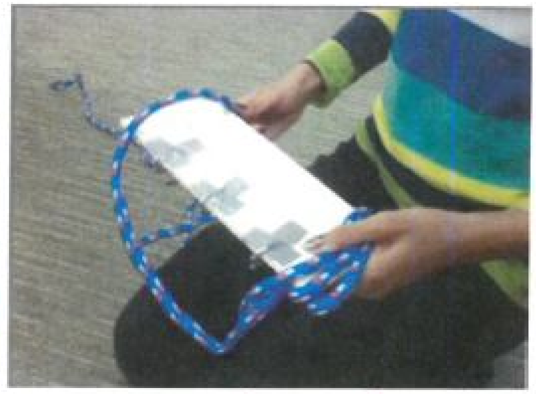

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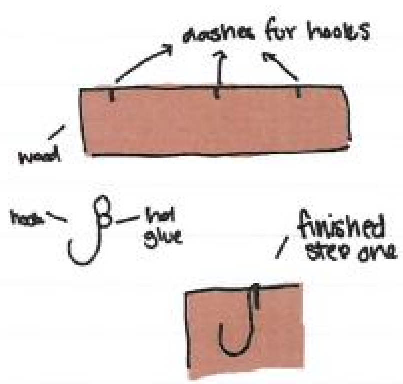

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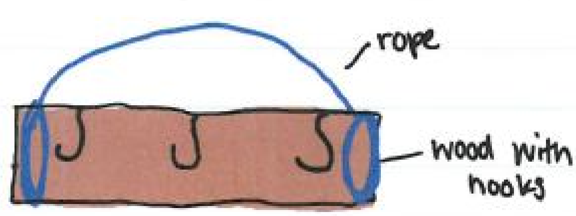

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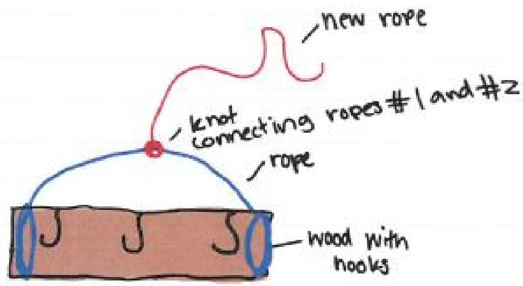
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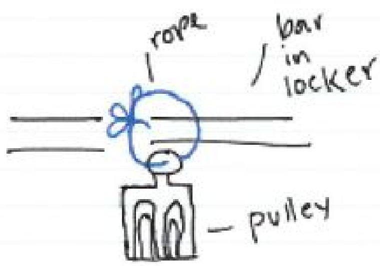
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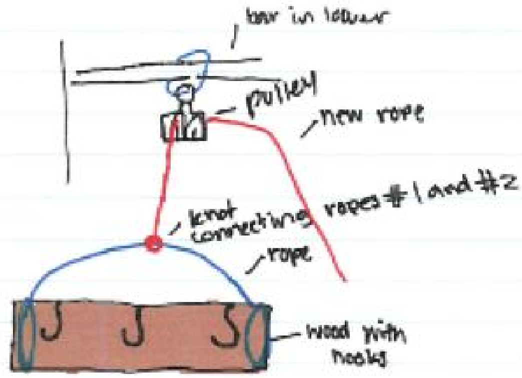
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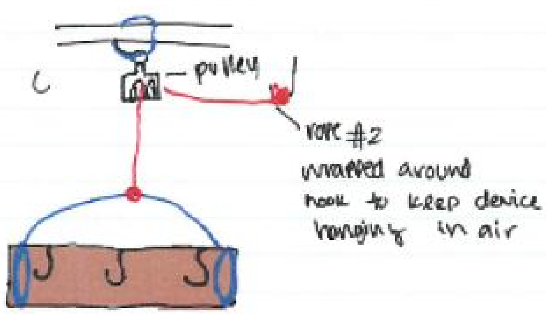
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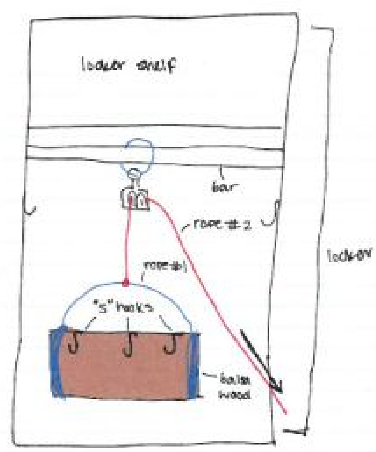
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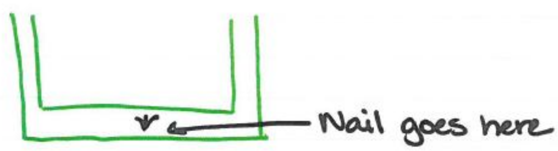

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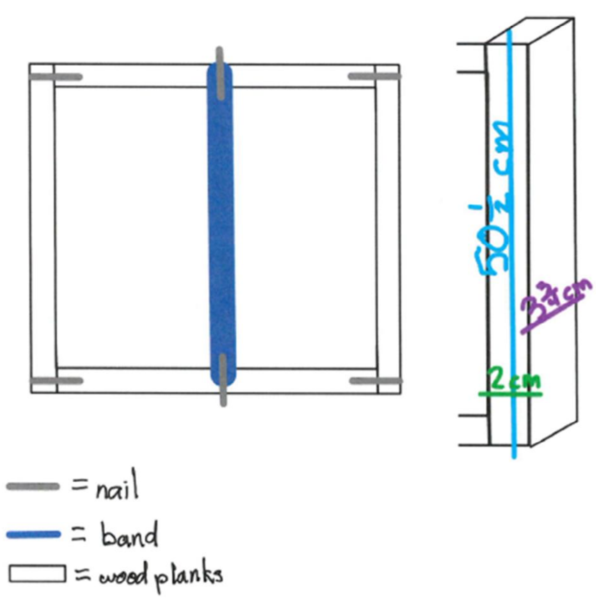

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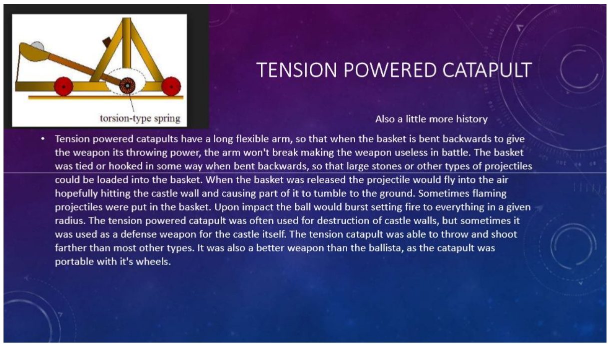

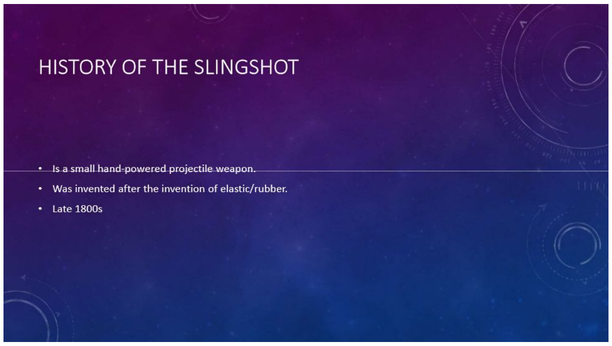

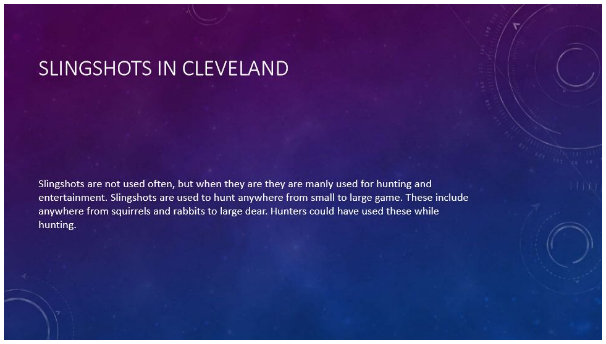

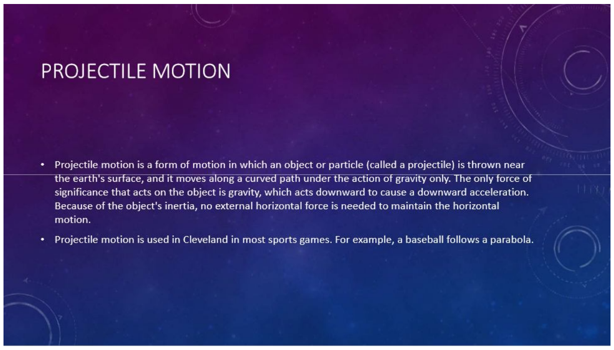

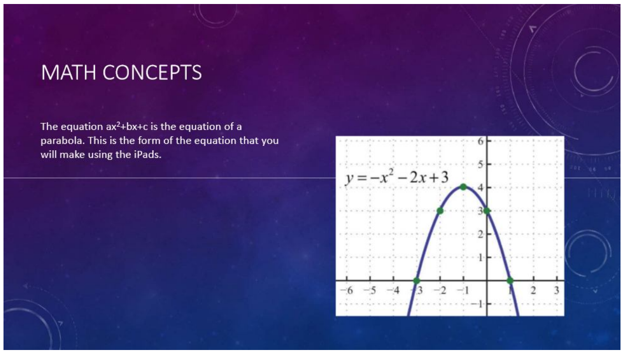

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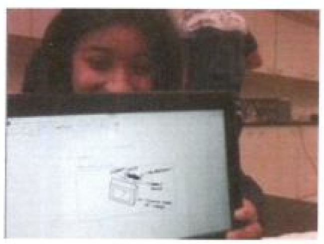

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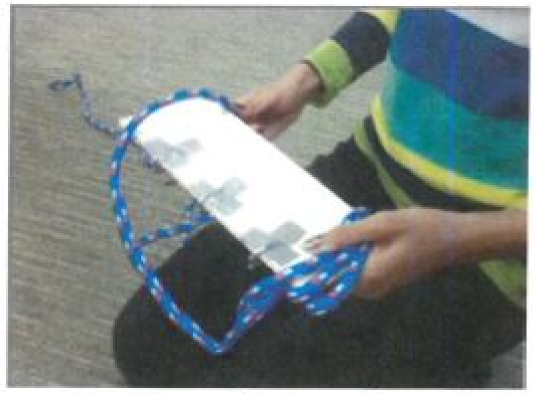

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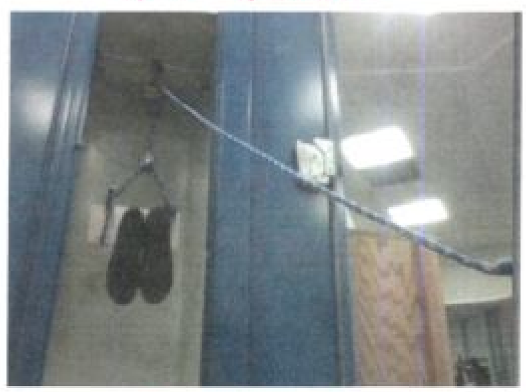

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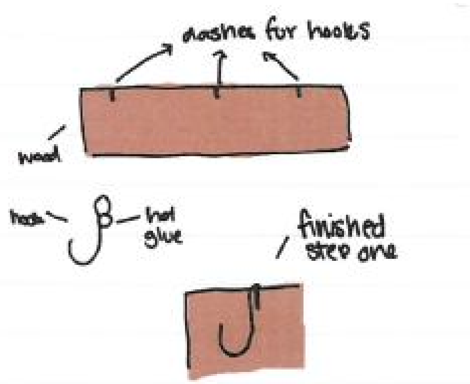

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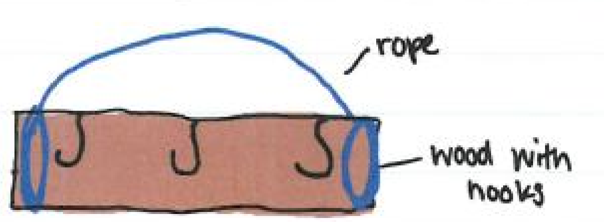

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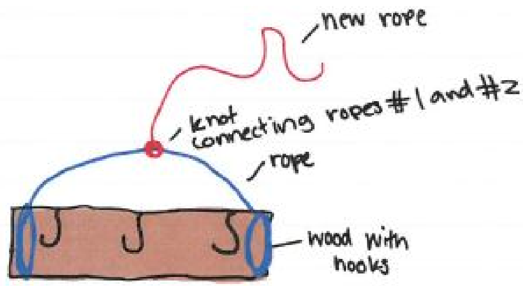
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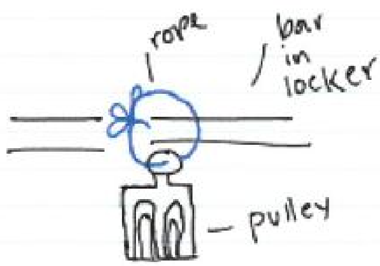
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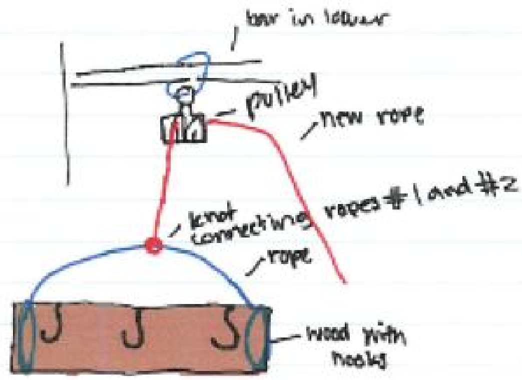
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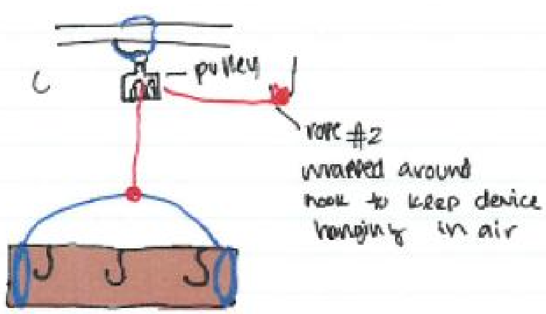
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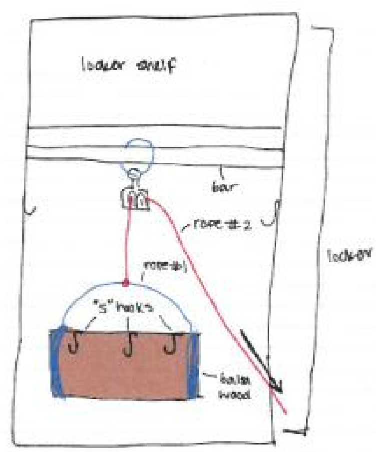
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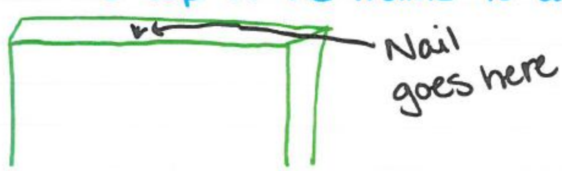

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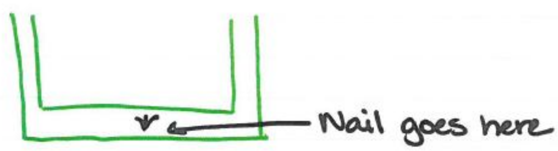

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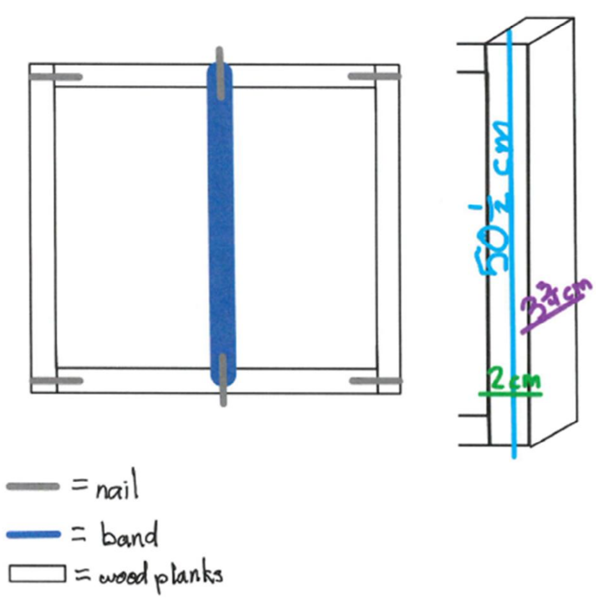

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PART 3: CONSTRUCTION + DATA COLLECTION

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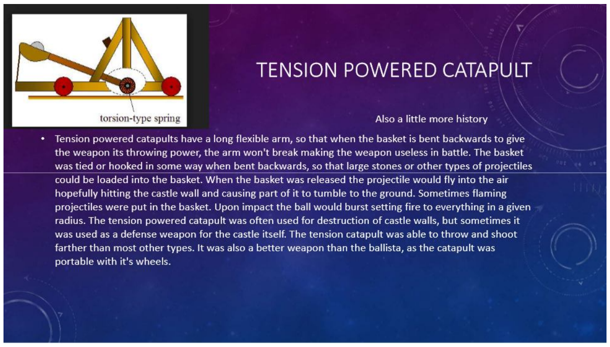

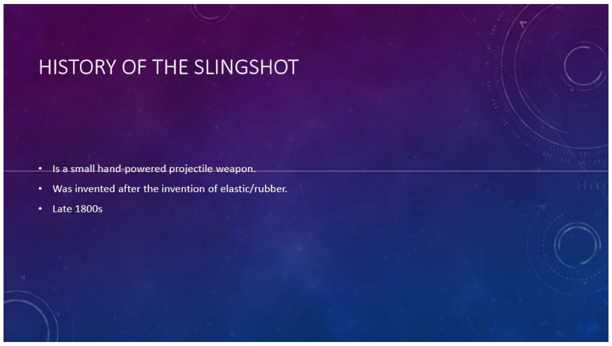

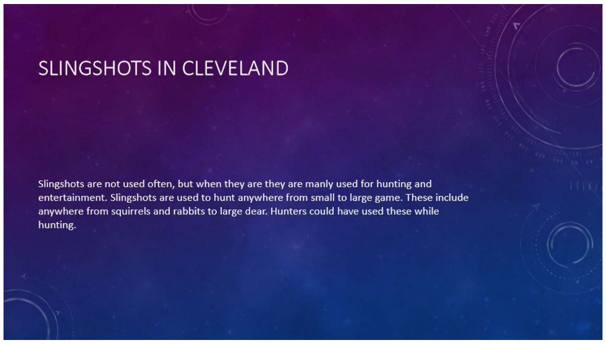

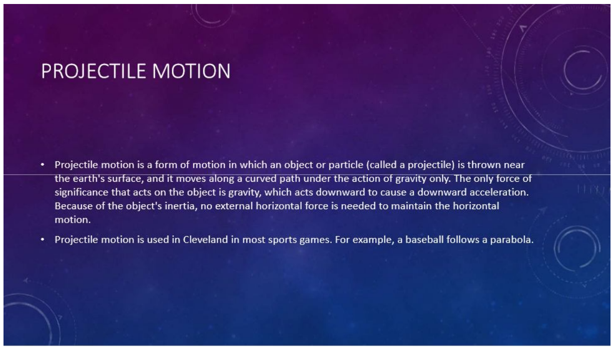

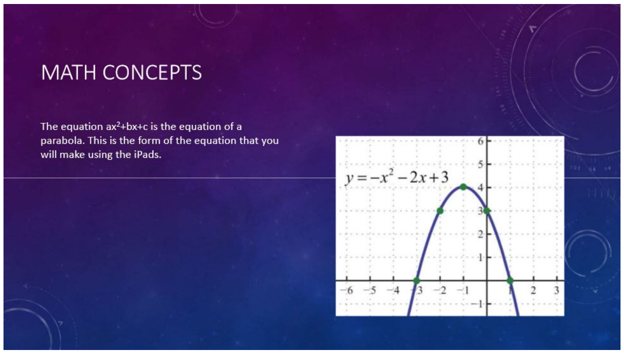

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Simple Machines Design Challenge

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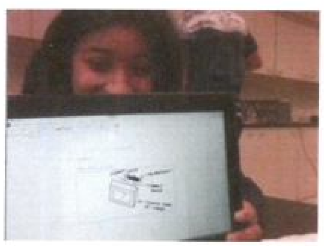

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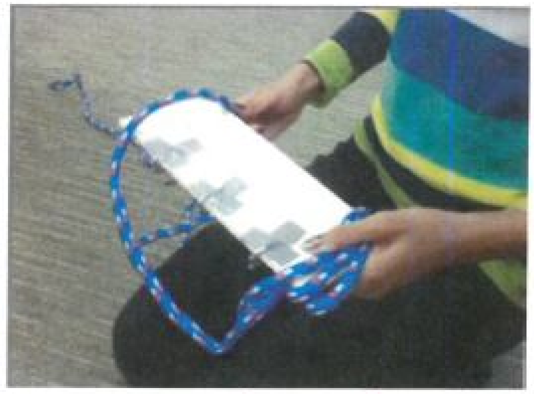

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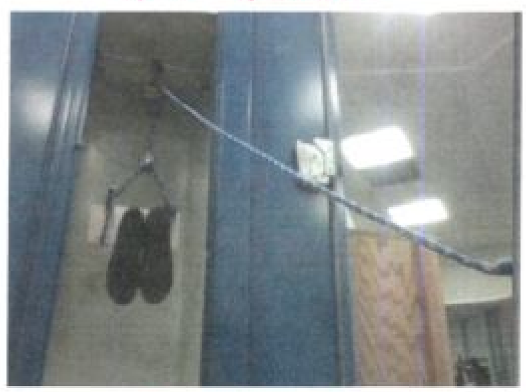

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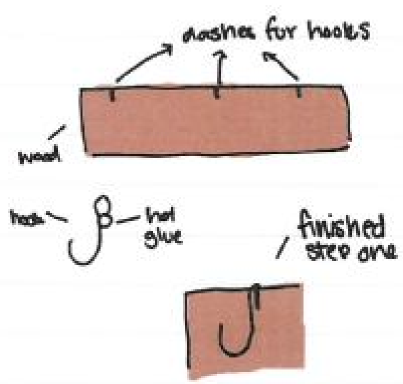

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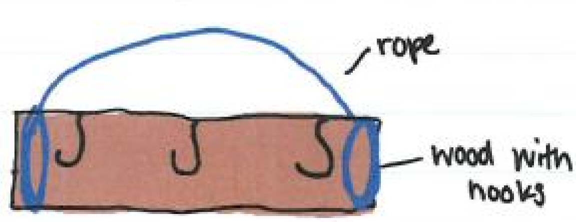

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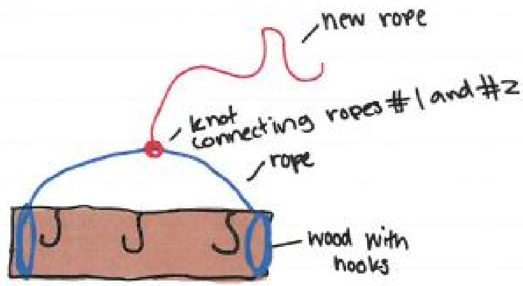
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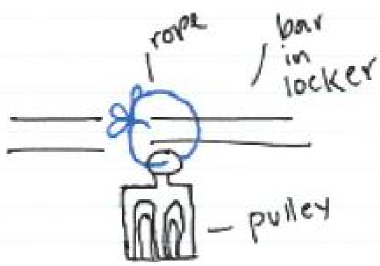
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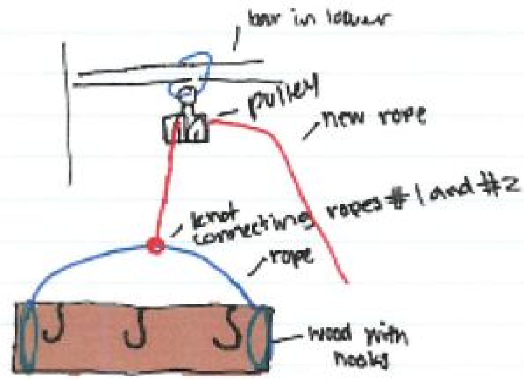
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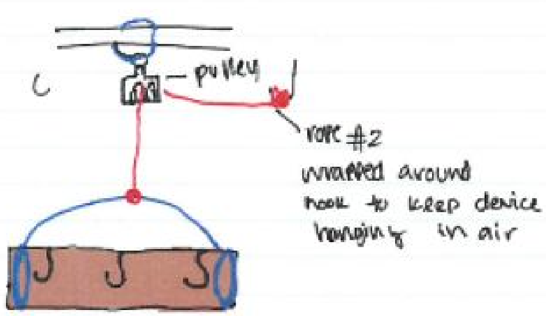
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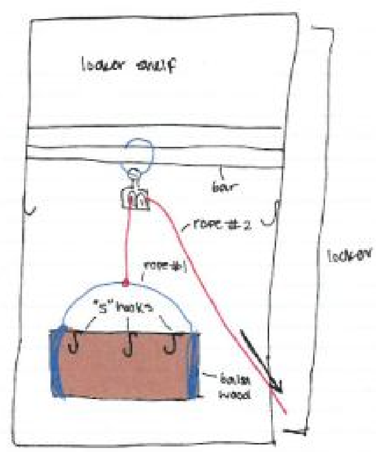
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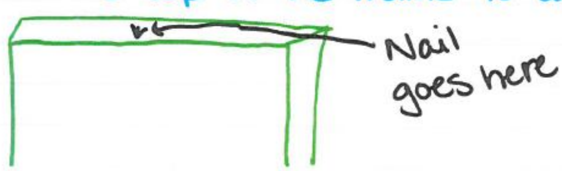

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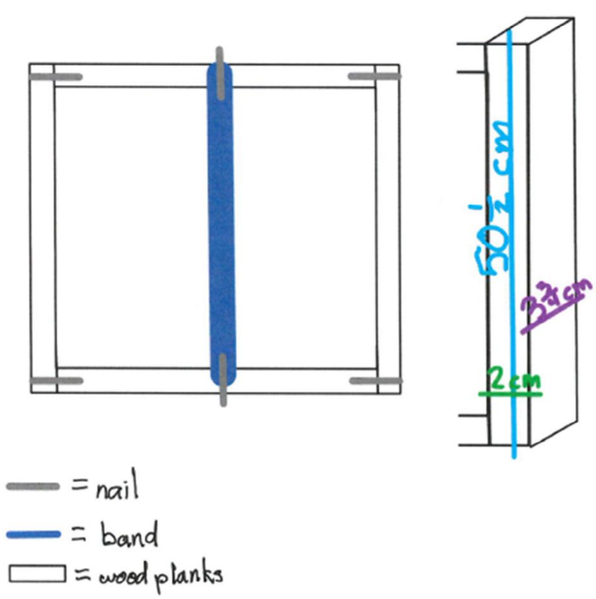

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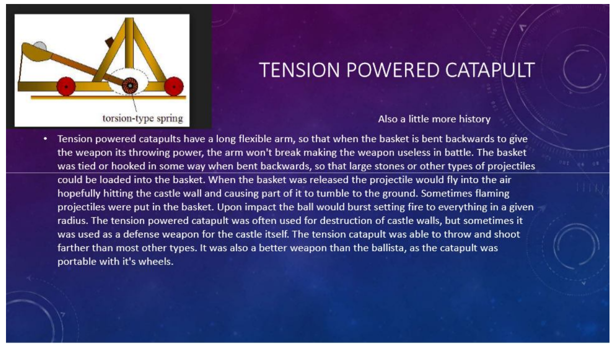

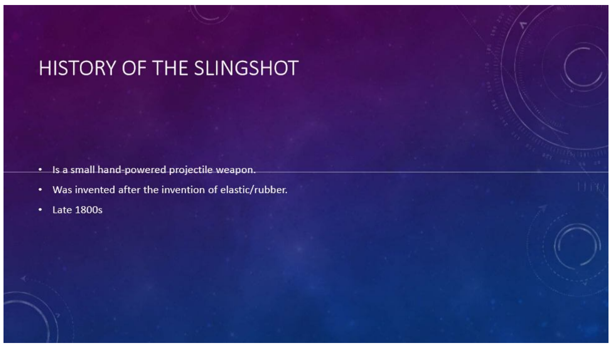

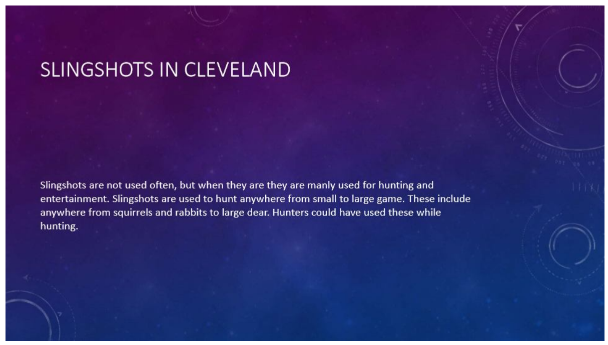

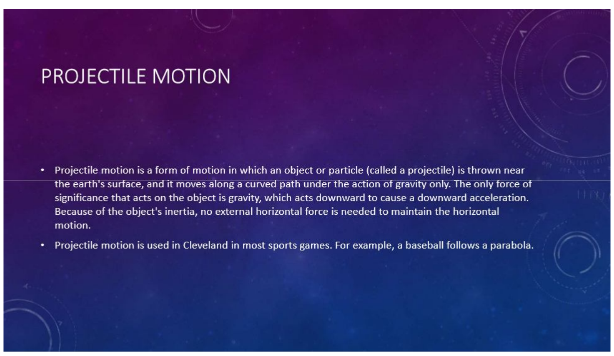

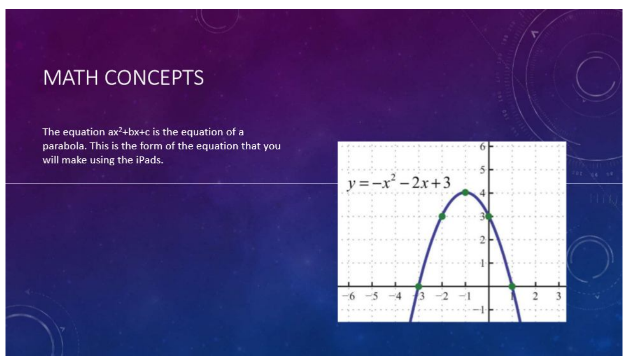

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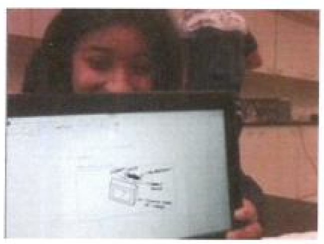

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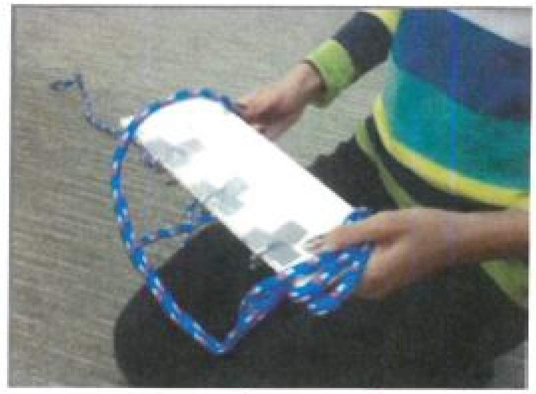

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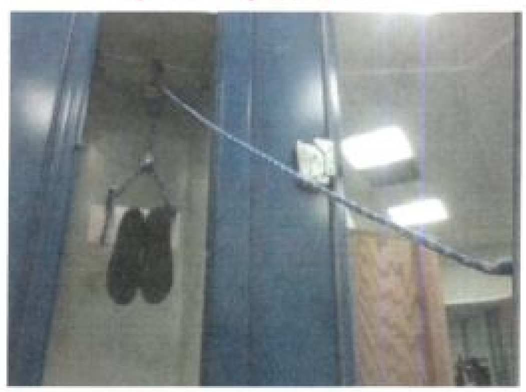

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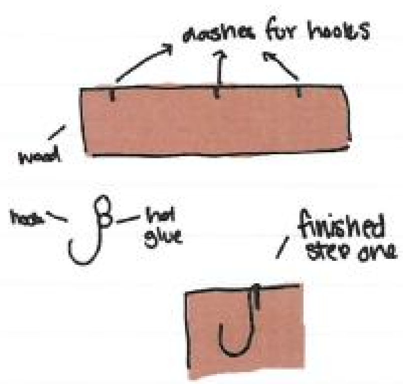

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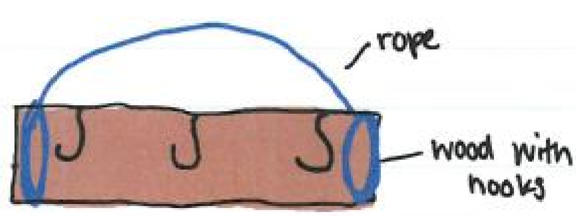

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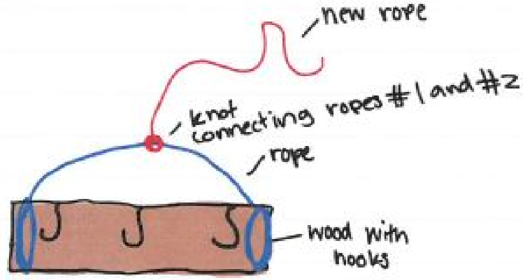
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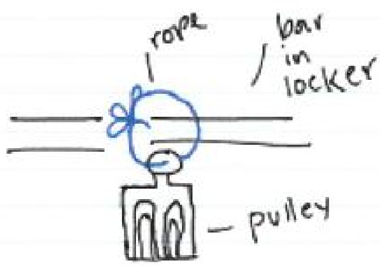
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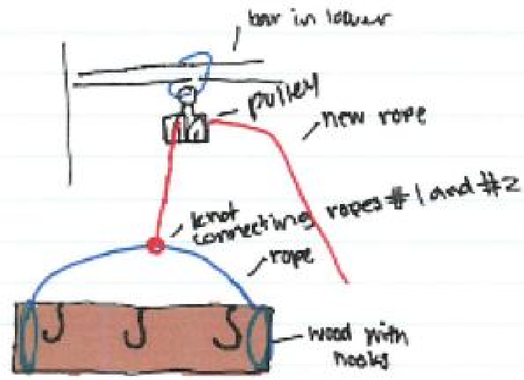
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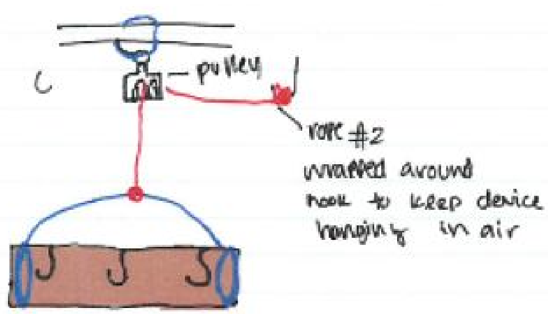
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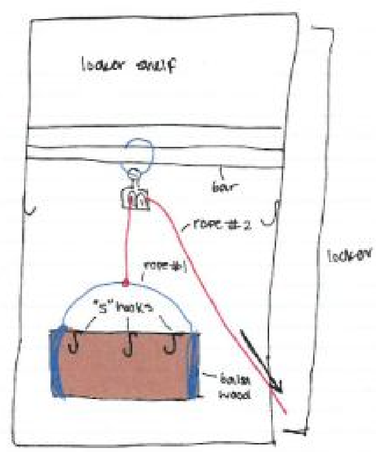
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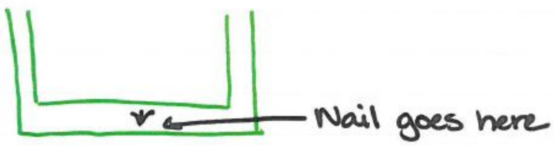

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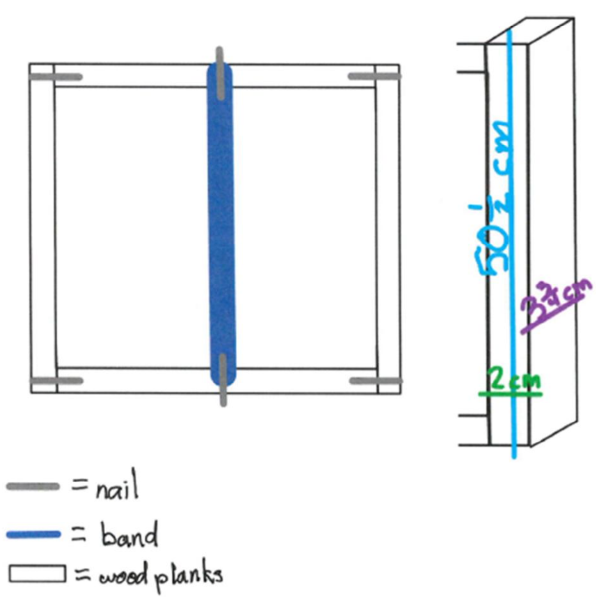

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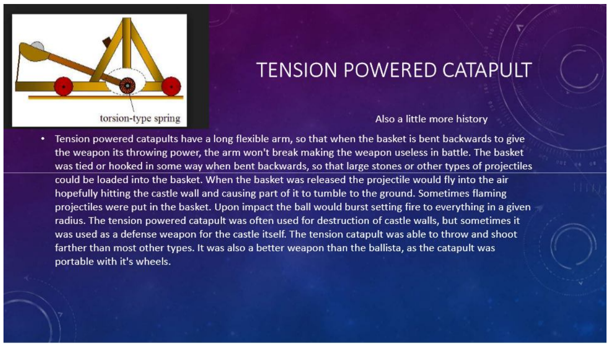

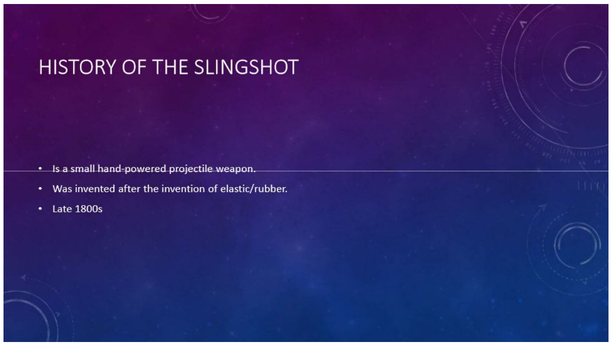

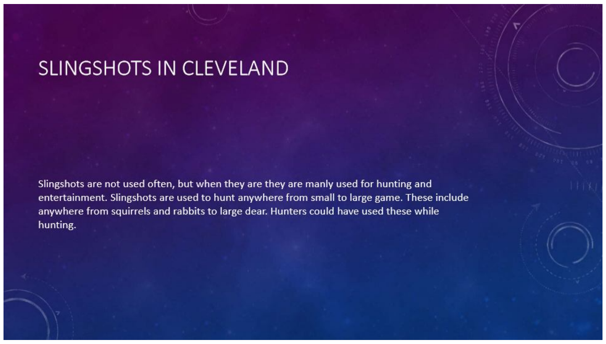

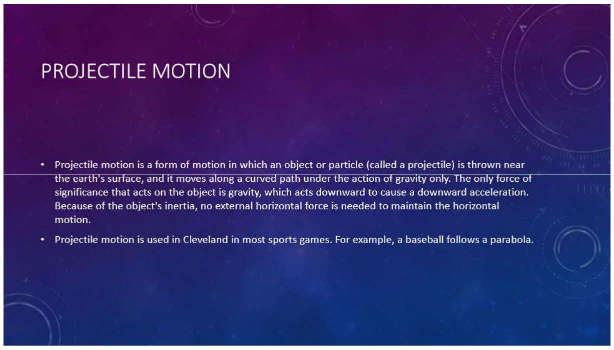

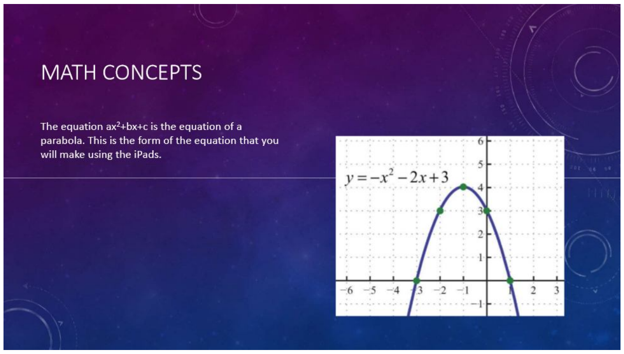

STUDENT EXAMPLES OF PROJECT COMPONENTS

Simple Machines Design Challenge

PHOTO TIMELINES

Design Phase:

Step 1- **Brainstorming**

In this step, we came up with the general idea of our catapult, the jobs, and organized our thoughts.

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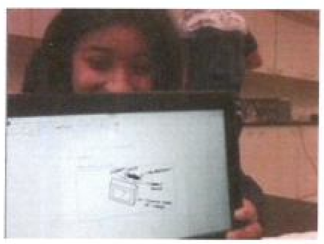

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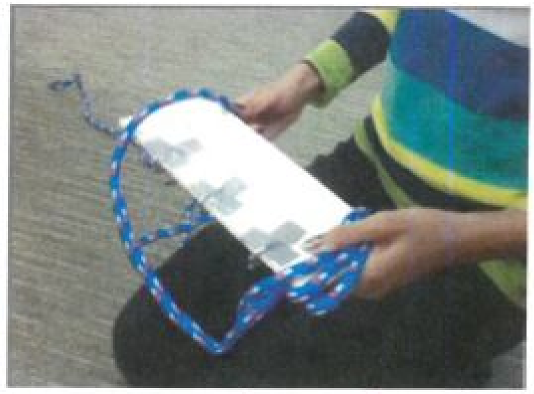

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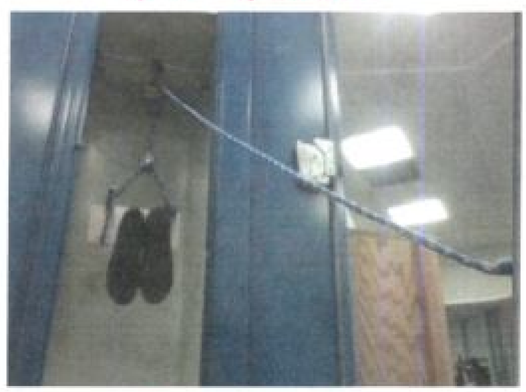

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This is the construction of the wooden frame

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1. Hot glue the hooks on to the wood where the dashes indicate. See picture one.
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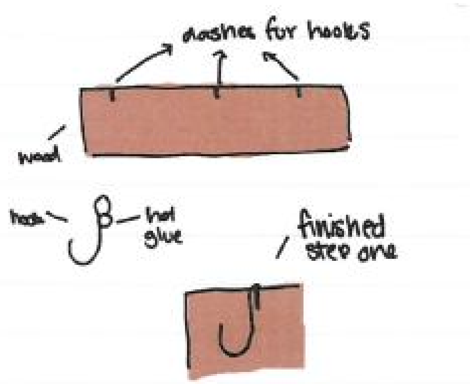

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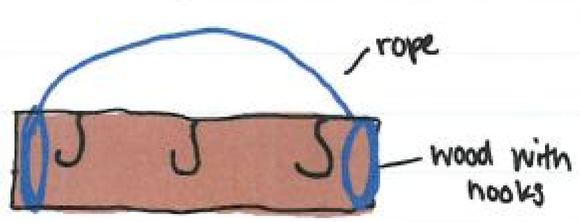

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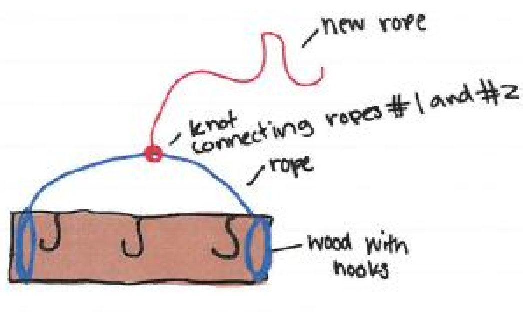
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knot connecting ropes #1 and #2
rope
wood with hooks

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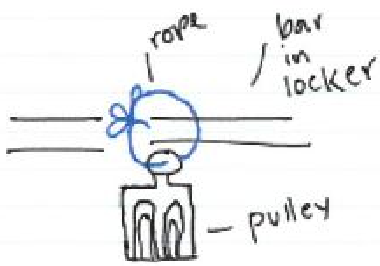
rope
bar in locker
pulley

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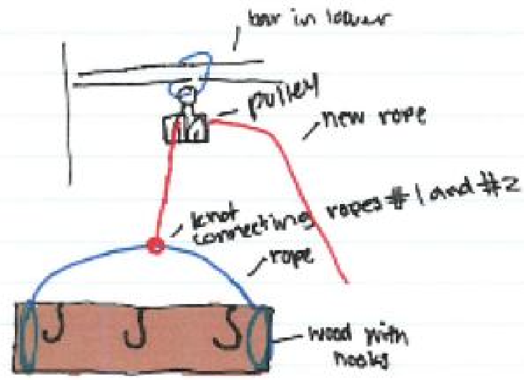
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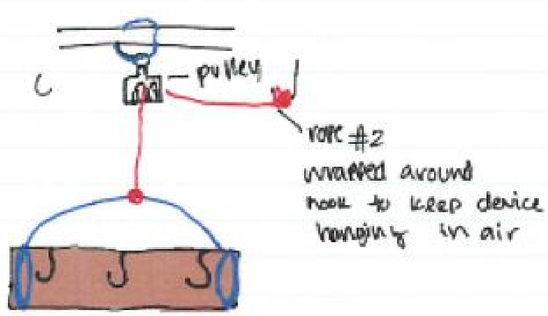
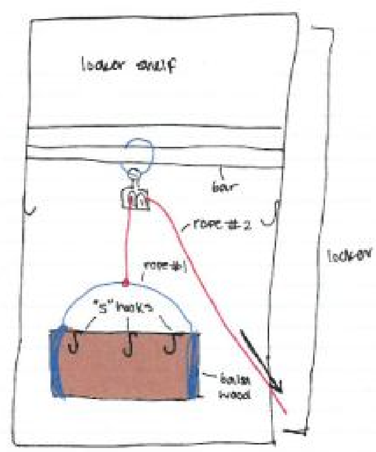

pulley
rope #2
wrapped around hook to keep device hanging in air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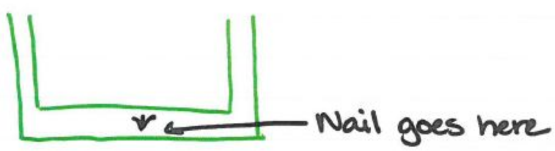

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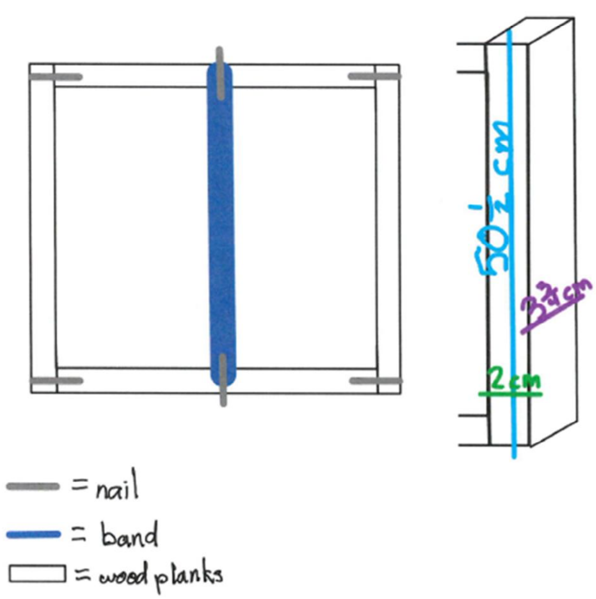

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PART 3: CONSTRUCTION & DATA COLLECTION

Type of machine constructed ~

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Task to complete ~

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Data Collection ~

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**** Complete the below with the whole class ****

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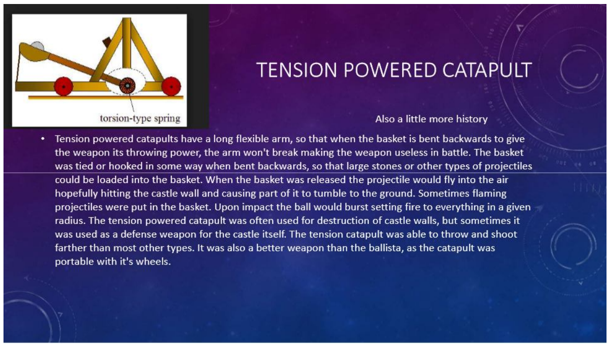

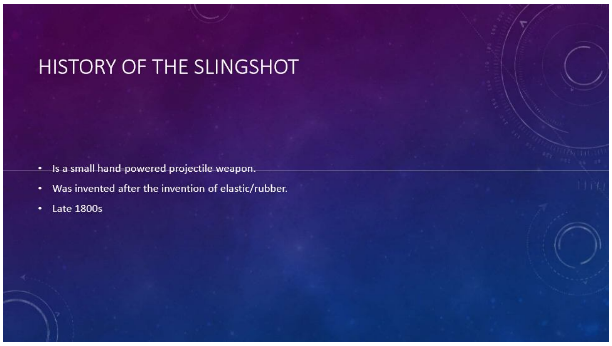

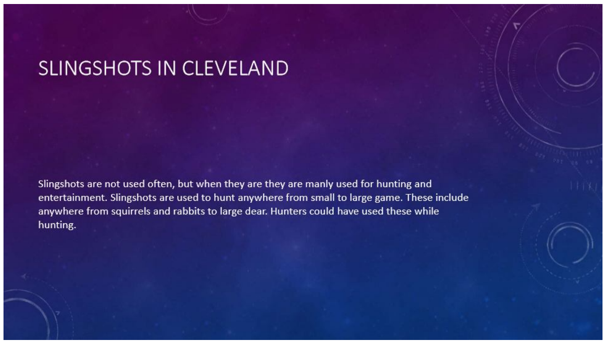

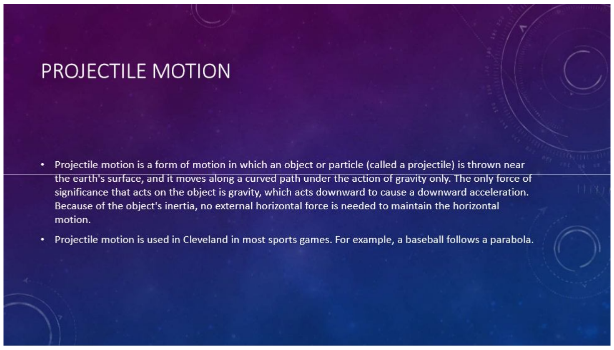

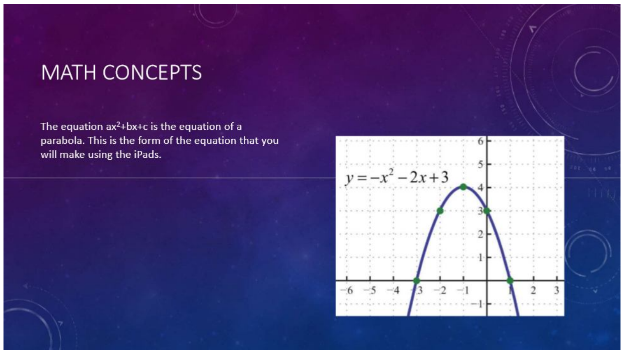

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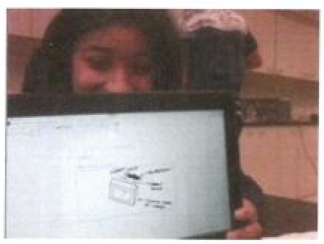

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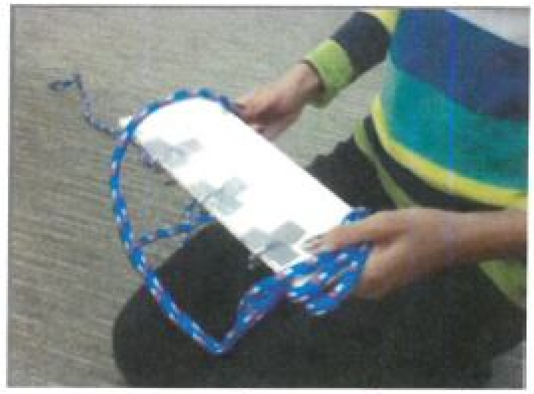

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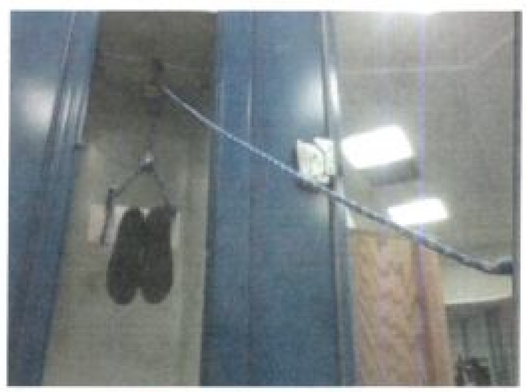

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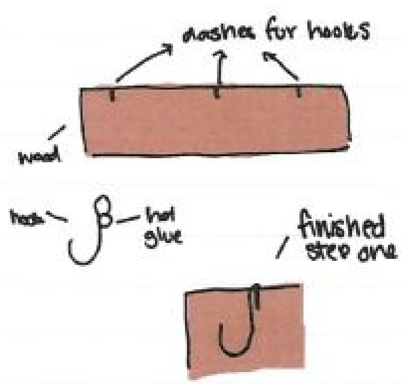

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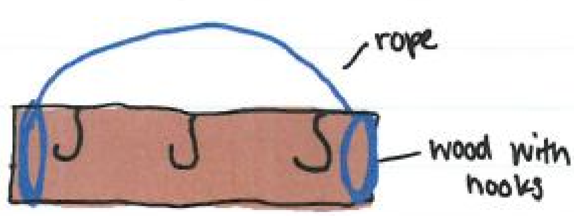

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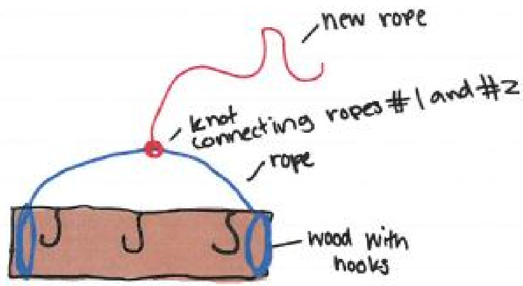
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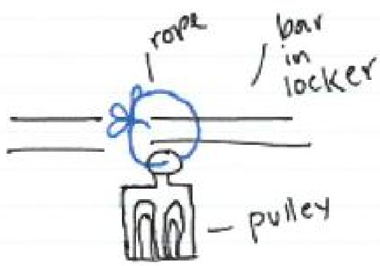
rope
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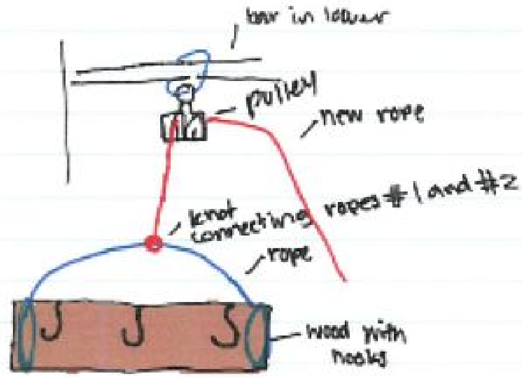
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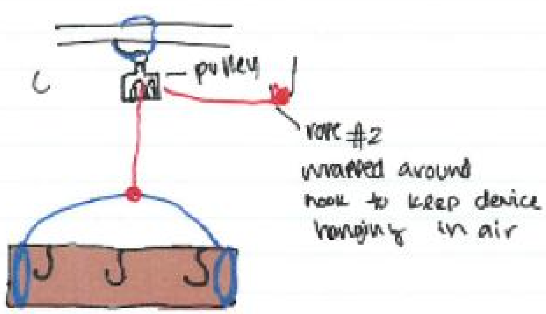
pulley
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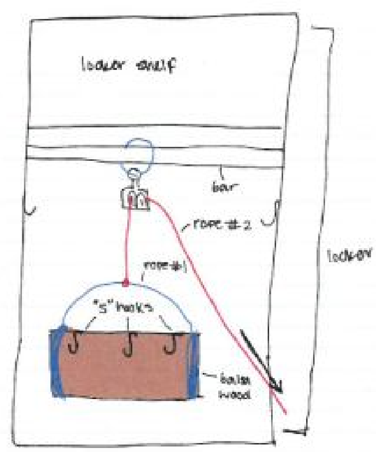
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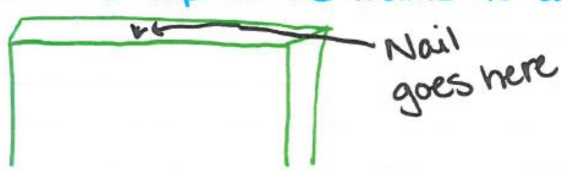

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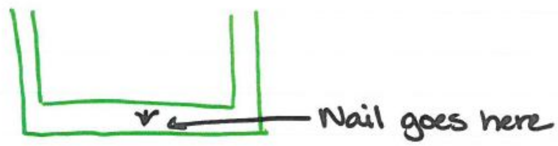

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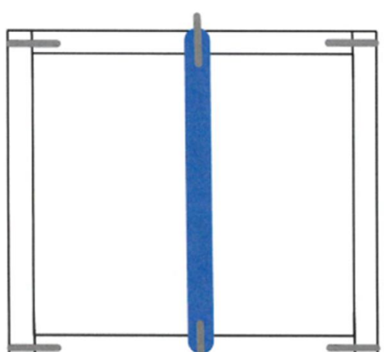

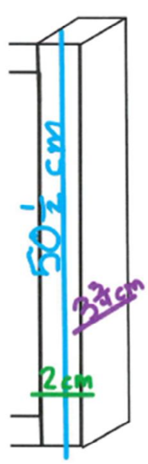

= nail
= band
= wood planks

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Launching a newspaper

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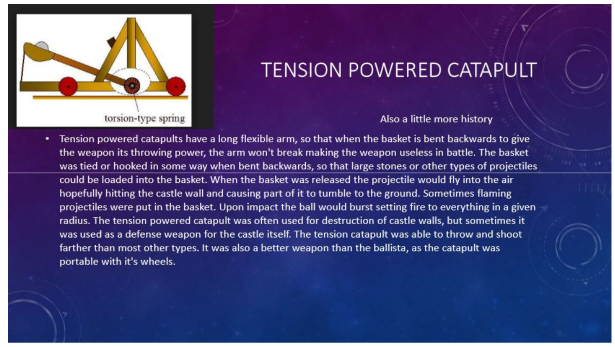

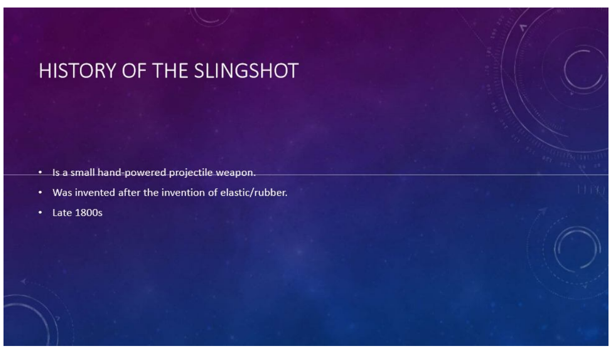

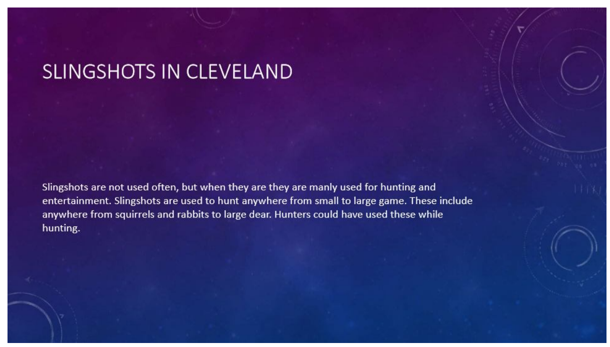

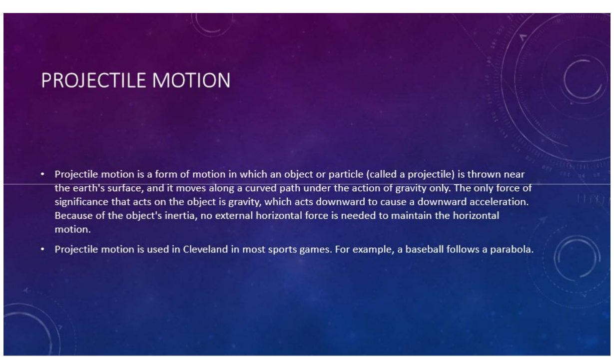

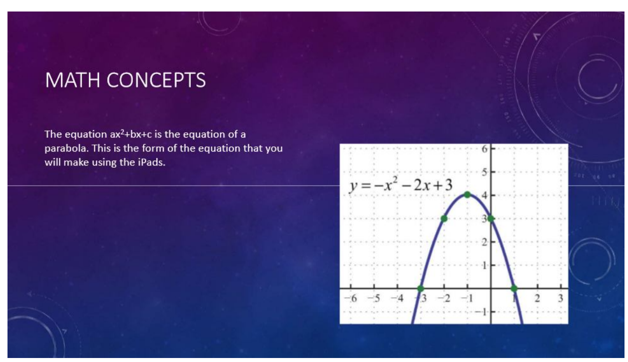

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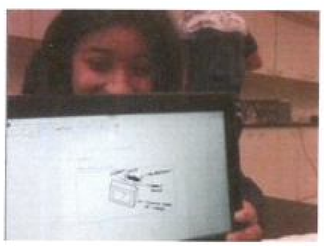

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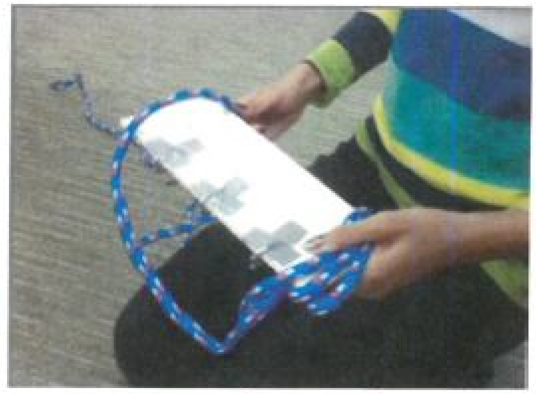

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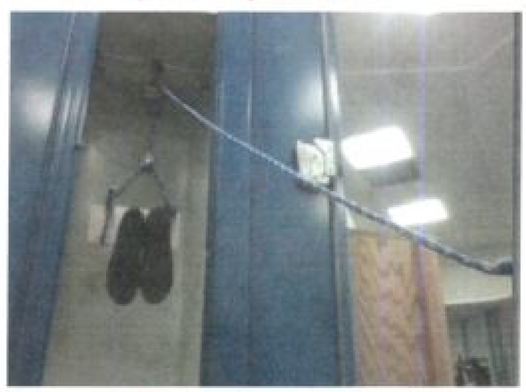

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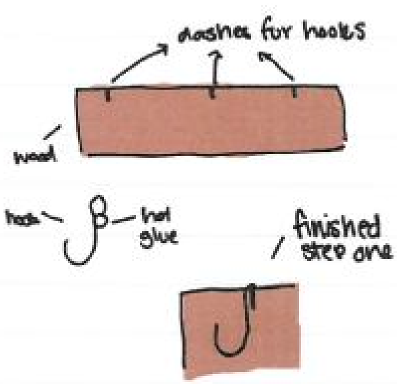

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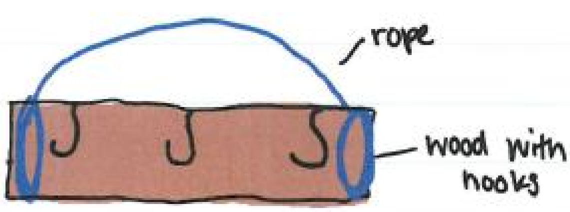

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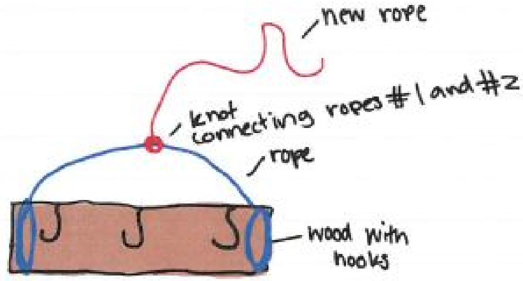
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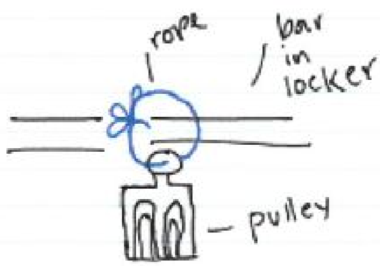
rope
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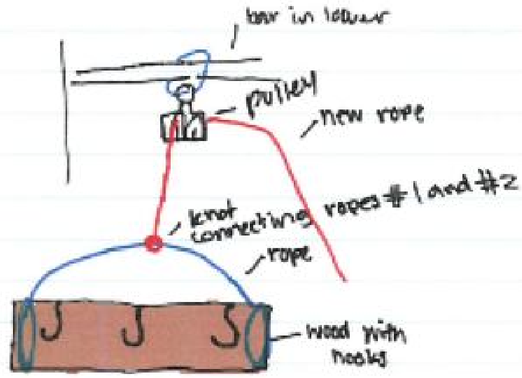
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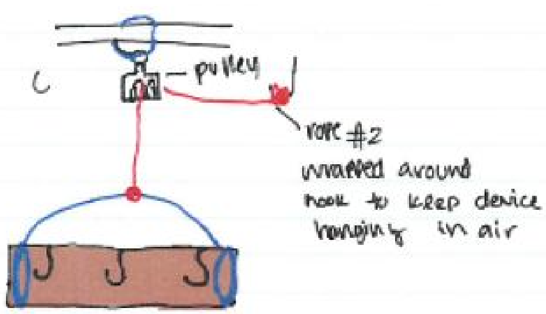
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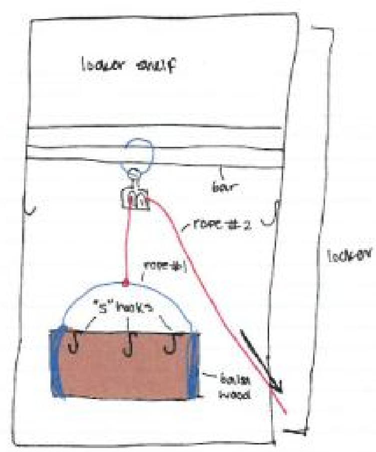
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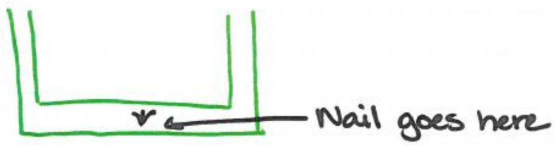

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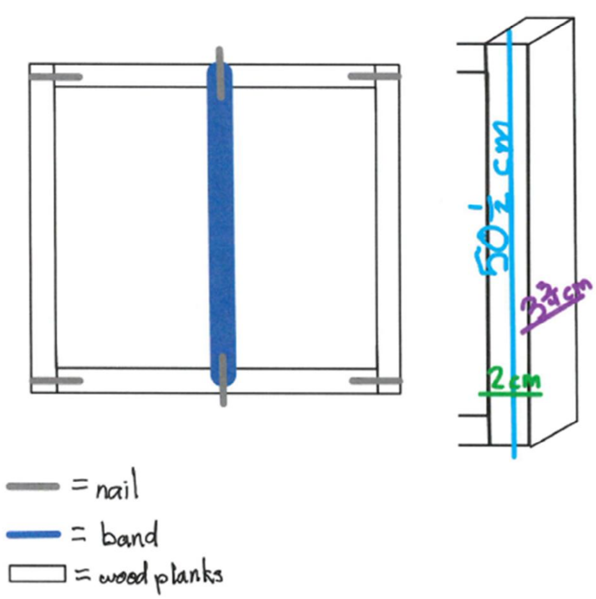

DATA COLLECTION/MATH CONCEPTS TABLE

PART 3: CONSTRUCTION + DATA COLLECTION

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Projectile B

Task to complete ~

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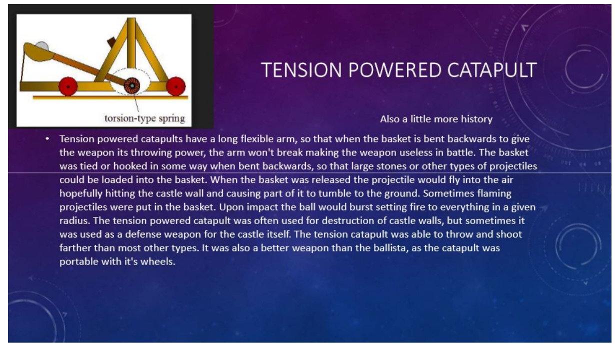

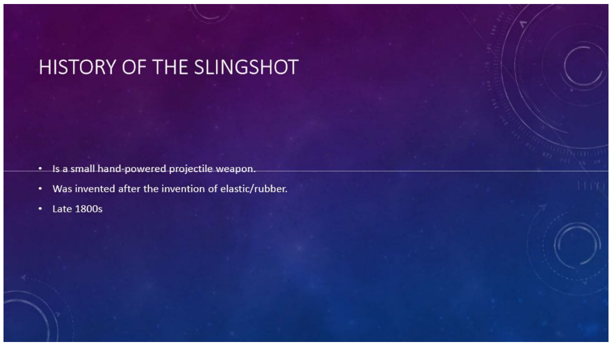

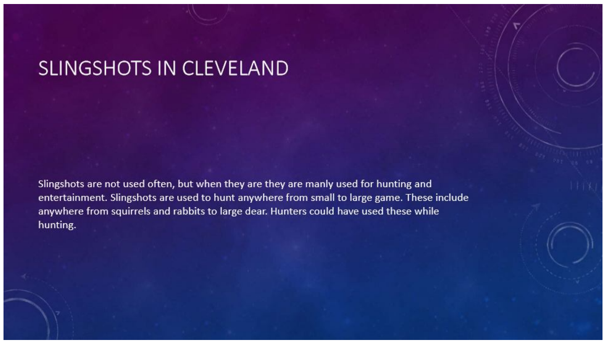

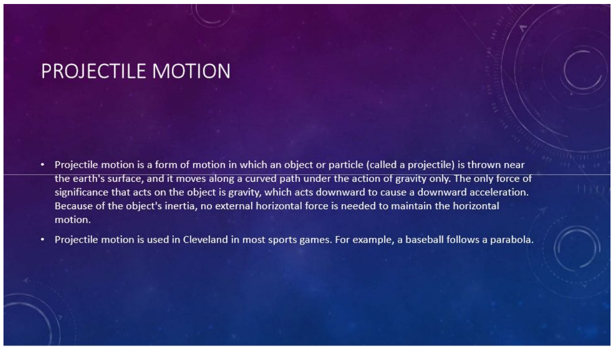

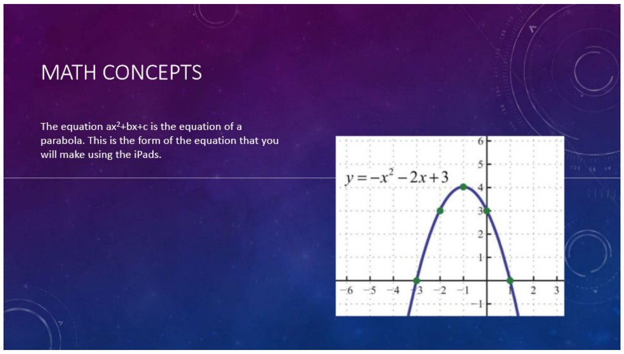

STUDENT EXAMPLES OF PROJECT COMPONENTS

Simple Machines Design Challenge

PHOTO TIMELINES

Design Phase:

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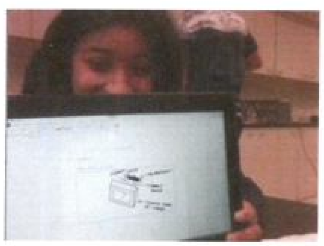

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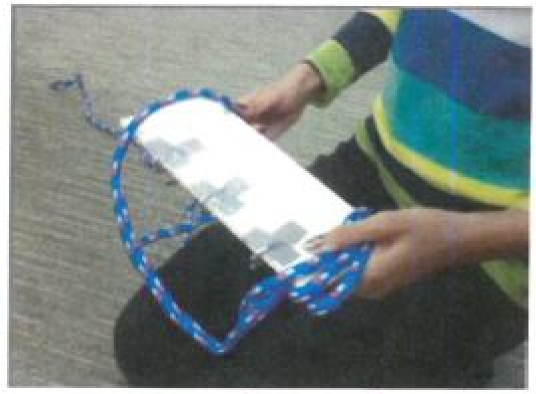

1st Step - tying rope to hooks

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This is the construction of the wooden frame

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This is the frame and us attaching the elastic band to the frame with nails.

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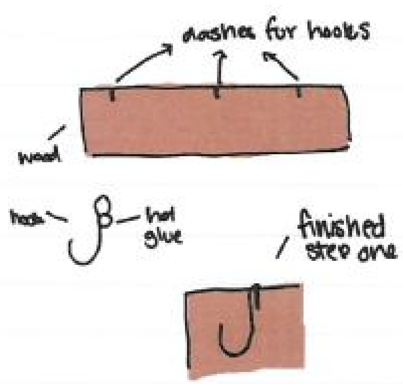

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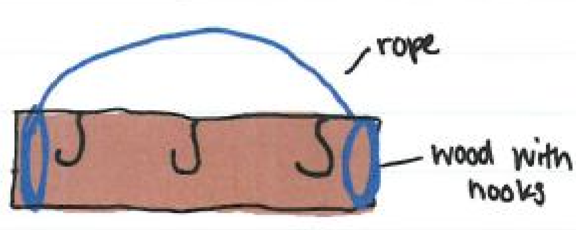

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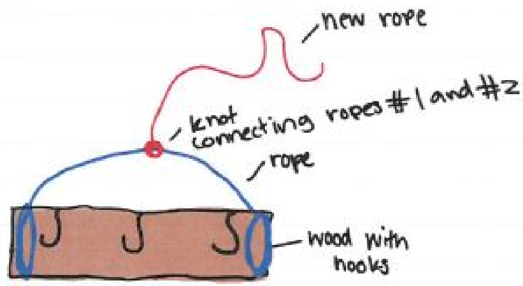
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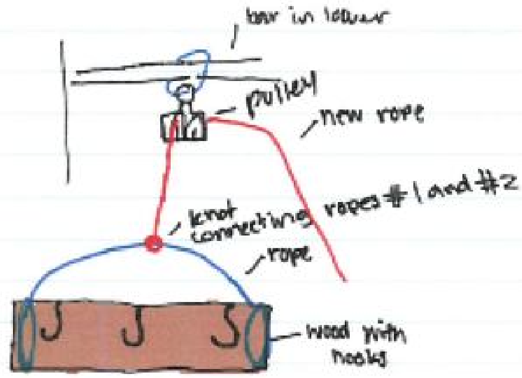
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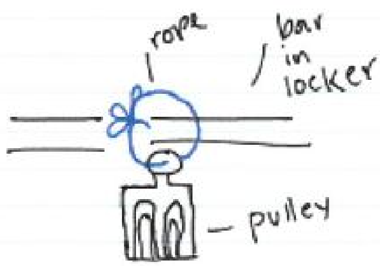
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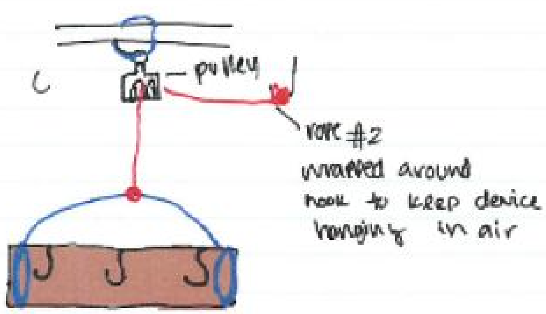
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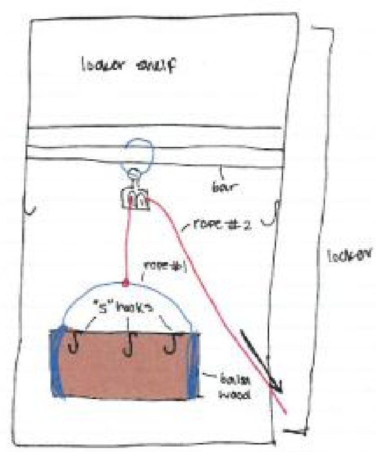
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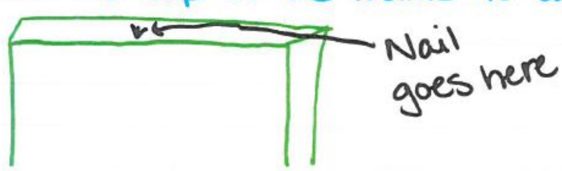

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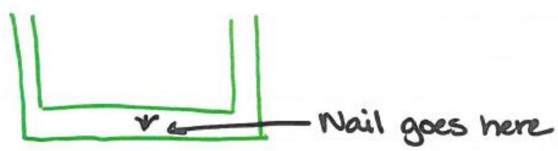

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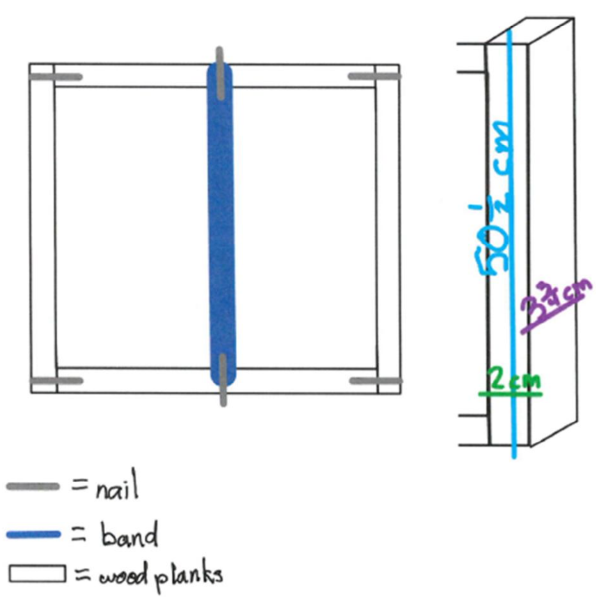

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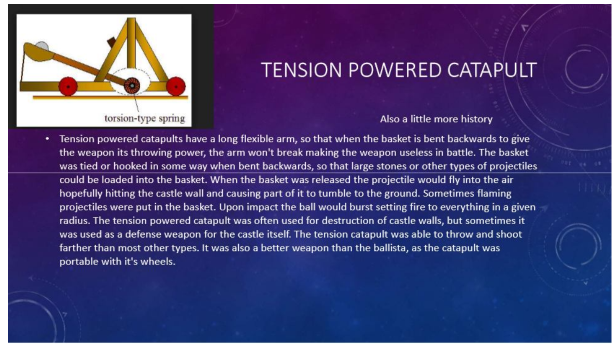

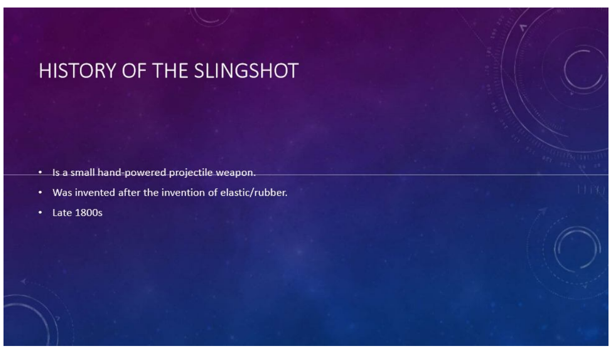

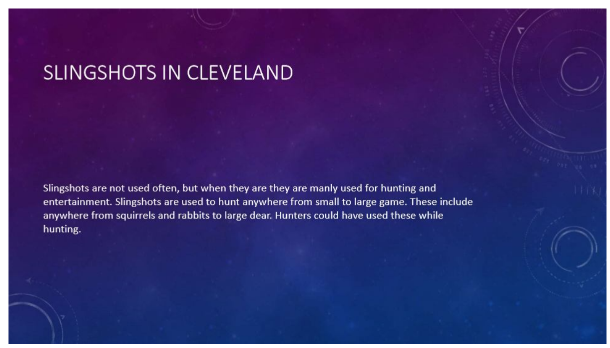

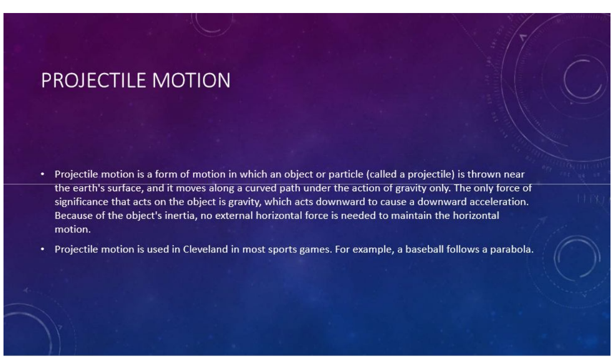

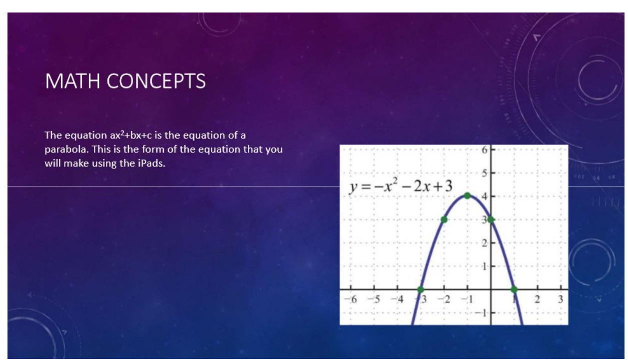

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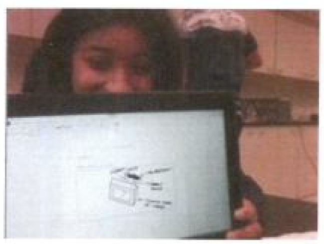

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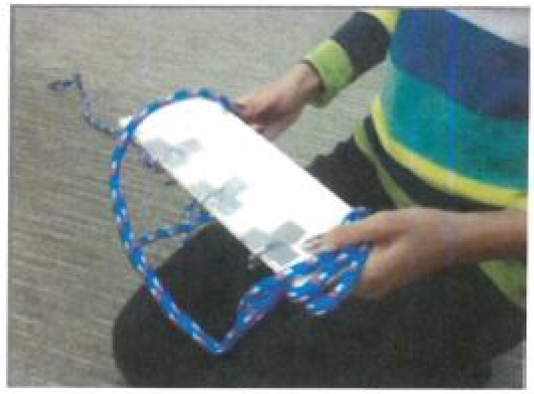

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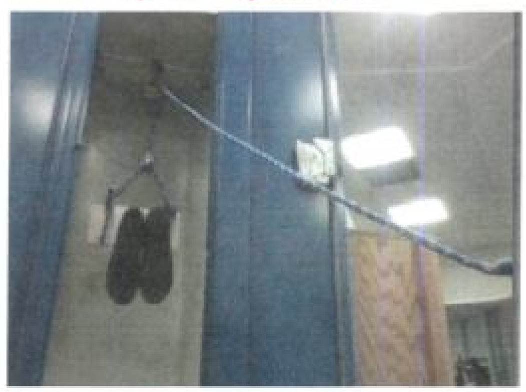

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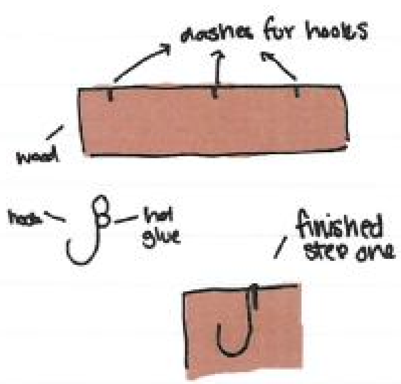

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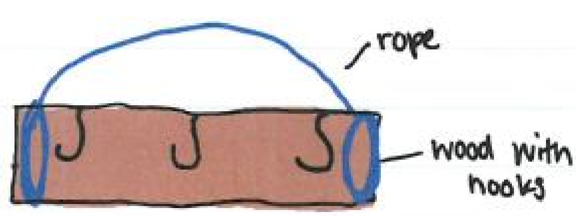

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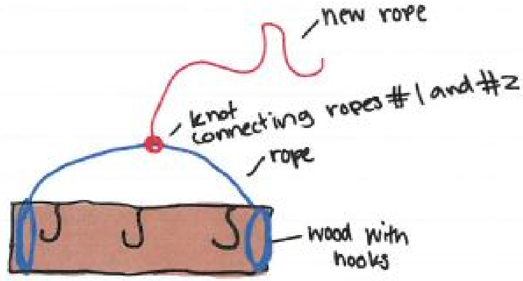
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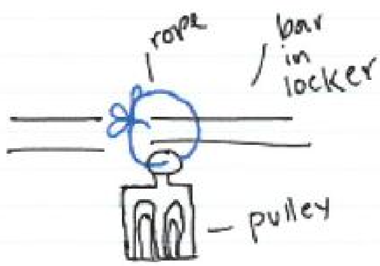
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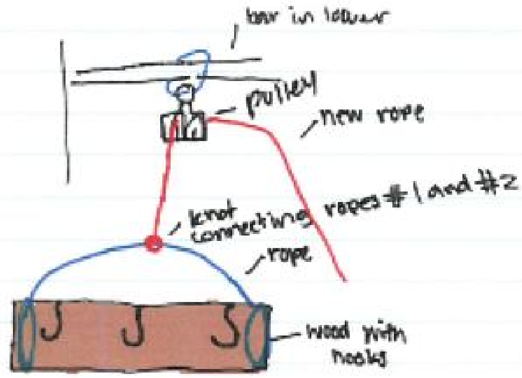
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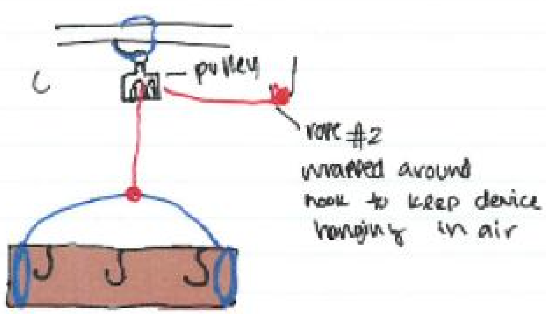
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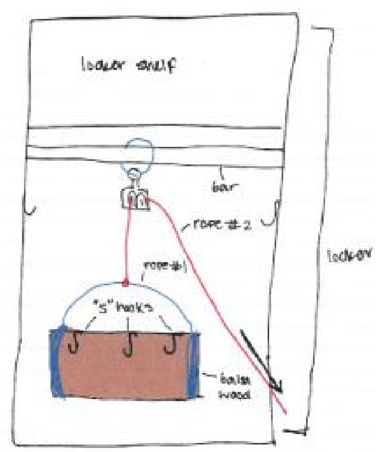
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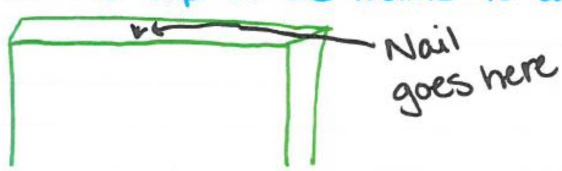

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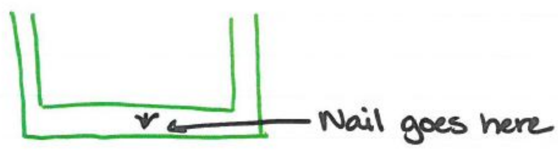

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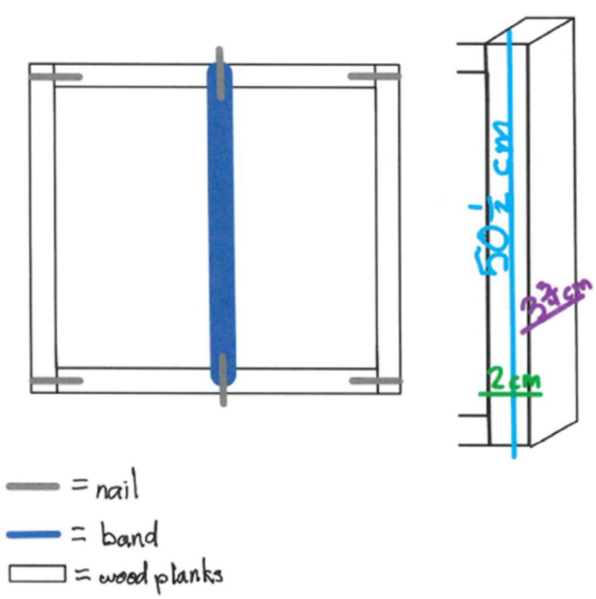

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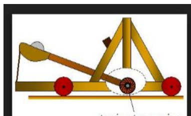
PRESENTATION

HISTORY OF THE CATAPULT

- It was used in the middles ages to help win battles and wars.
- Since castle walls were getting stronger, armies needed something that could break through them.
- Many kinds of catapults were used.
- Some are tension powered, trebuchet, torsion powered, gravity powered, and traction powered.



TENSION POWERED CATAPULT

Also a little more history

- Tension powered catapults have a long flexible arm, so that when the basket is bent backwards to give the weapon its throwing power, the arm won't break making the weapon useless in battle. The basket was tied or hooked in some way when bent backwards, so that large stones or other types of projectiles could be loaded into the basket. When the basket was released the projectile would fly into the air hopefully hitting the castle wall and causing part of it to tumble to the ground. Sometimes flaming projectiles were put in the basket. Upon impact the ball would burst setting fire to everything in a given radius. The tension powered catapult was often used for destruction of castle walls, but sometimes it was used as a defense weapon for the castle itself. The tension catapult was able to throw and shoot farther than most other types. It was also a better weapon than the ballista, as the catapult was portable with it's wheels.

HISTORY OF THE SLINGSHOT

- Is a small hand-powered projectile weapon.
- Was invented after the invention of elastic/rubber.
- Late 1800s

SLINGSHOTS IN CLEVELAND

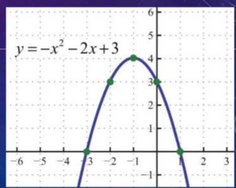
Slingshots are not used often, but when they are they are manly used for hunting and entertainment. Slingshots are used to hunt anywhere from small to large game. These include anywhere from squirrels and rabbits to large dear. Hunters could have used these while hunting.

PROJECTILE MOTION

- Projectile motion is a form of motion in which an object or particle (called a projectile) is thrown near the earth's surface, and it moves along a curved path under the action of gravity only. The only force of significance that acts on the object is gravity, which acts downward to cause a downward acceleration. Because of the object's inertia, no external horizontal force is needed to maintain the horizontal motion.
- Projectile motion is used in Cleveland in most sports games. For example, a baseball follows a parabola.

MATH CONCEPTS

The equation ax^2+bx+c is the equation of a parabola. This is the form of the equation that you will make using the iPads.



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Simple Machines Design Challenge

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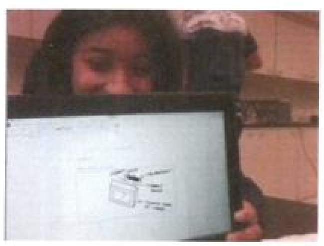

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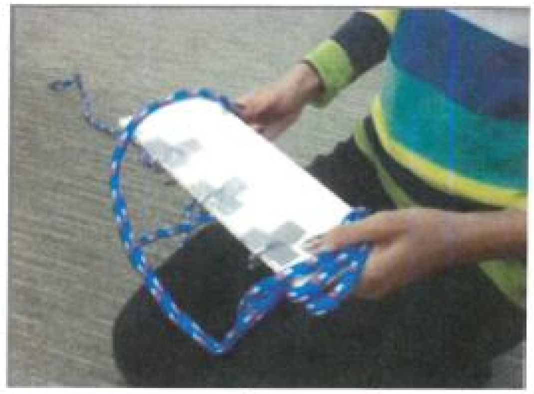

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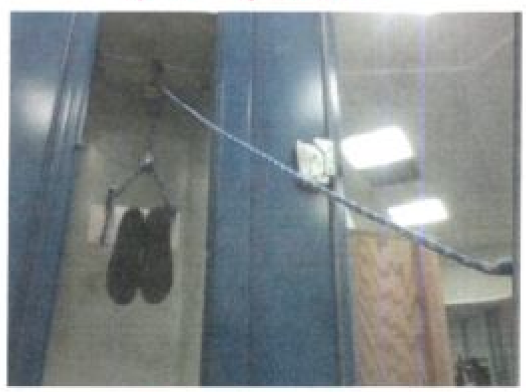

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1. Hot glue the hooks on to the wood where the dashes indicate. See picture one.
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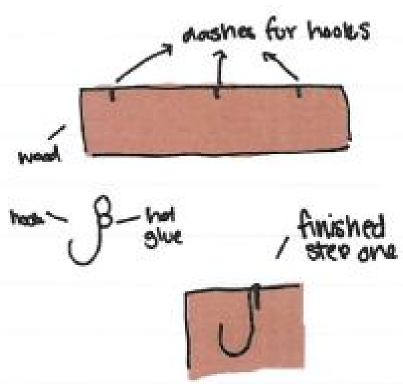

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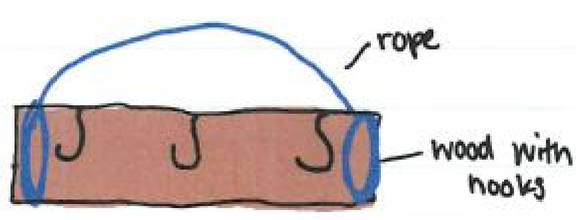

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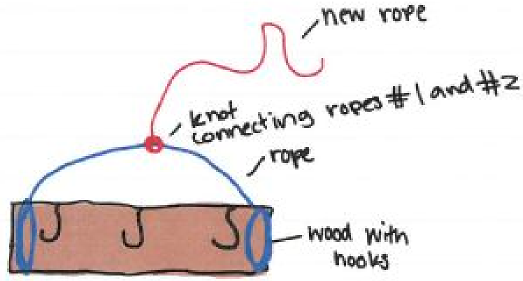
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rope
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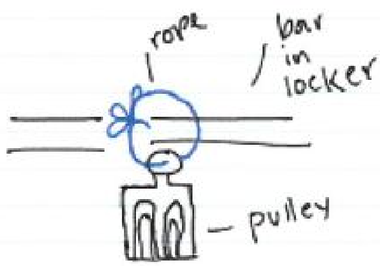
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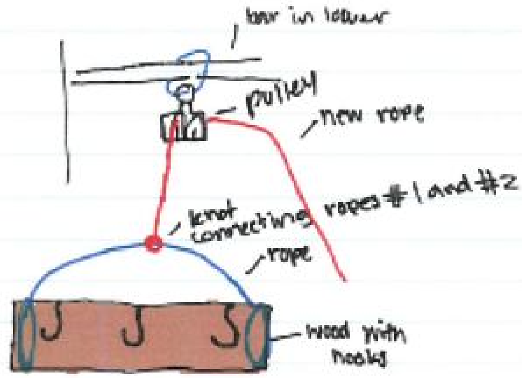
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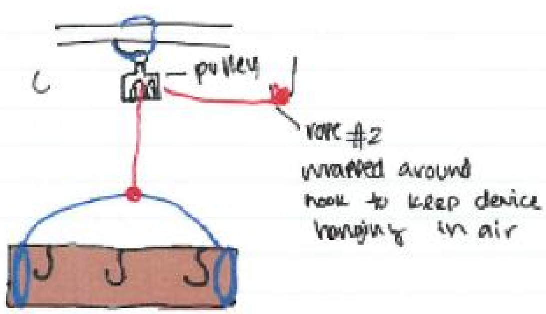
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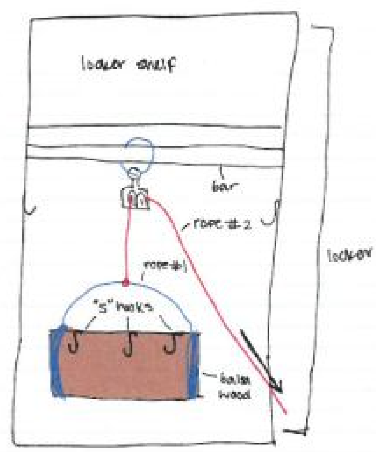
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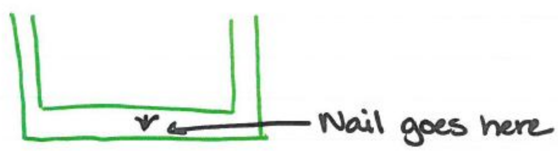

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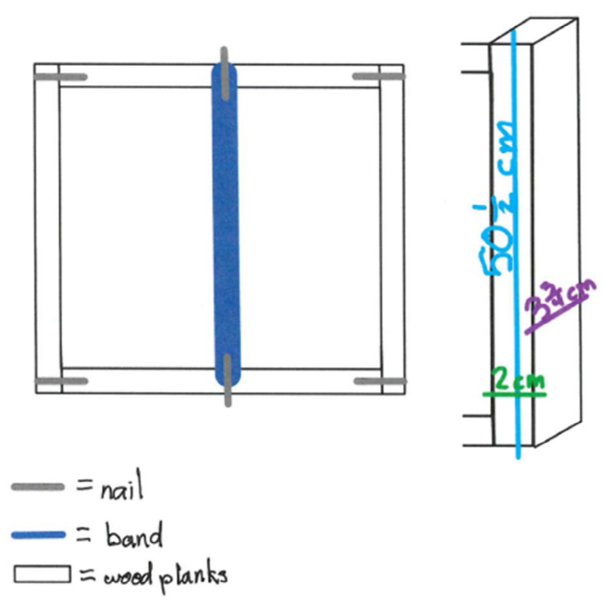

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Task to complete ~

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Data Collection ~

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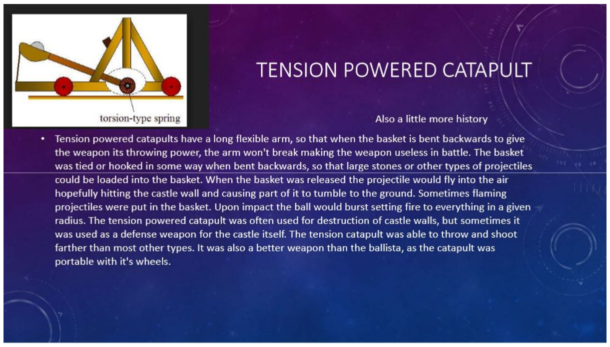

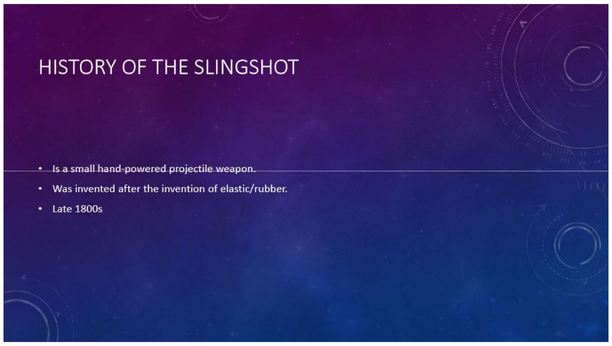

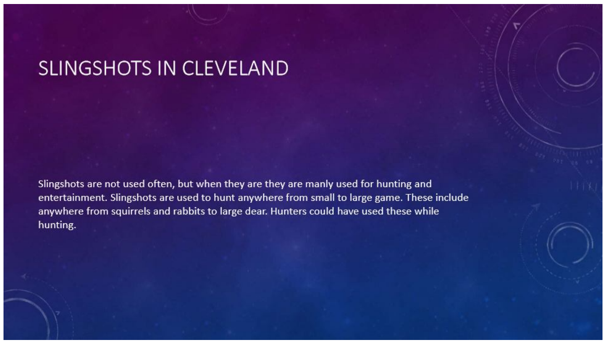

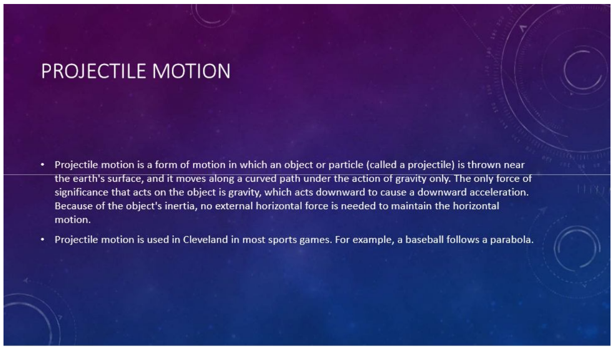

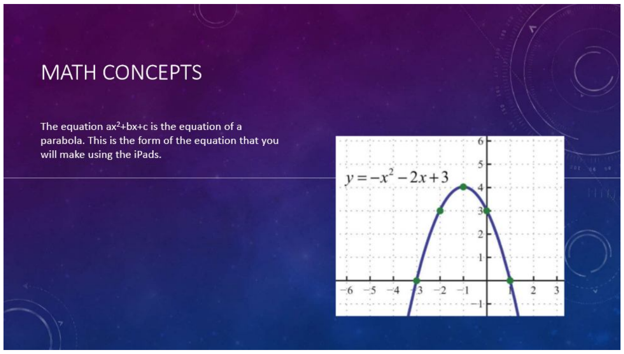

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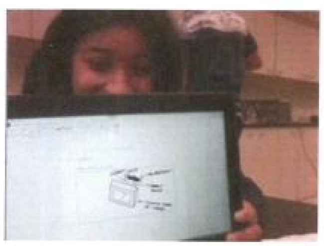

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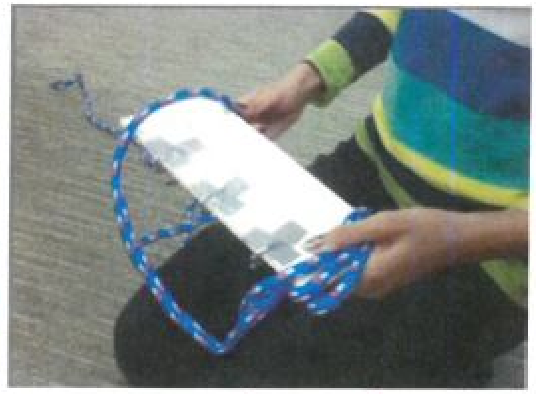

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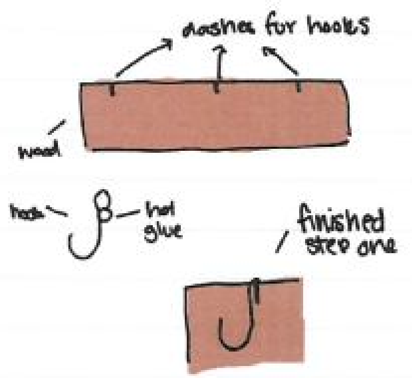

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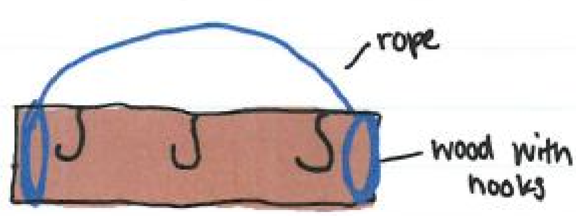

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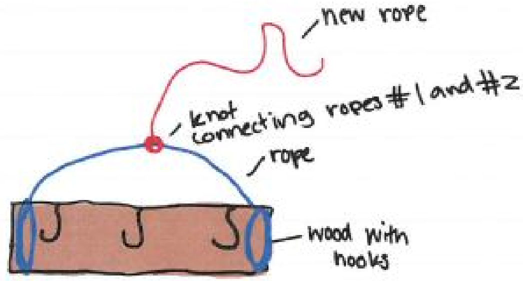
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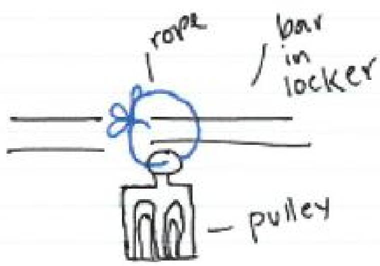
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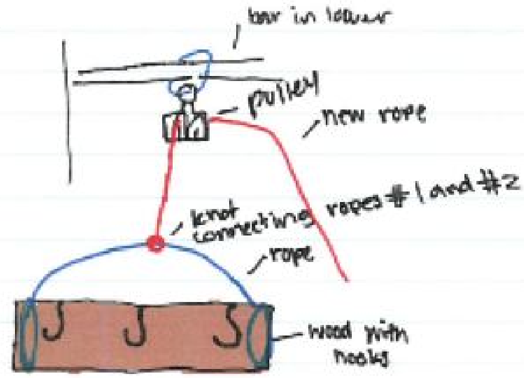
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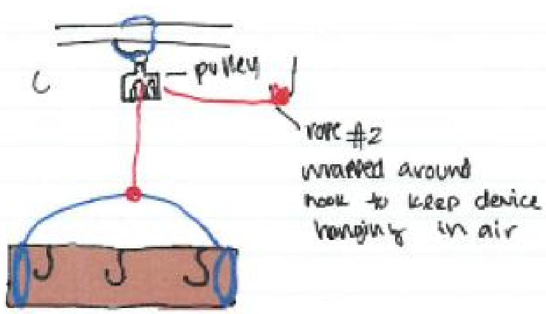
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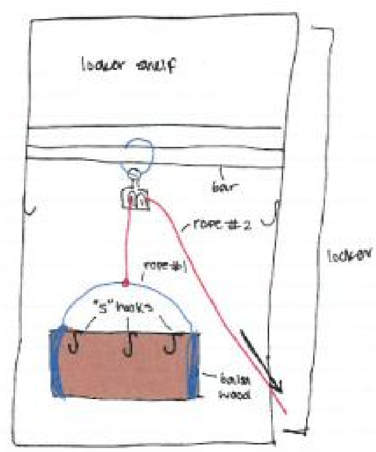
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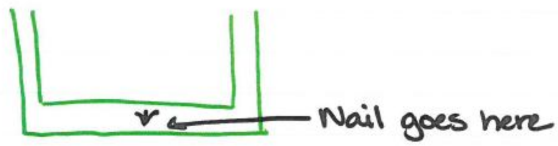

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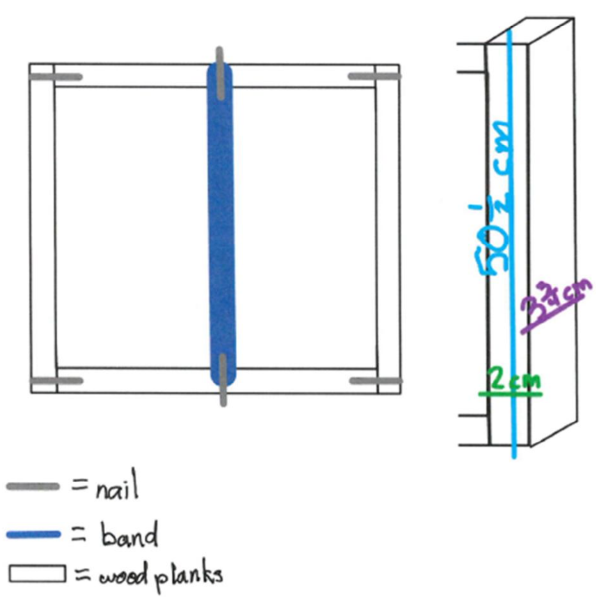

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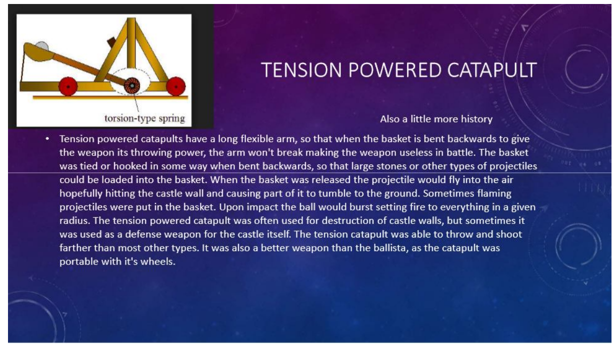

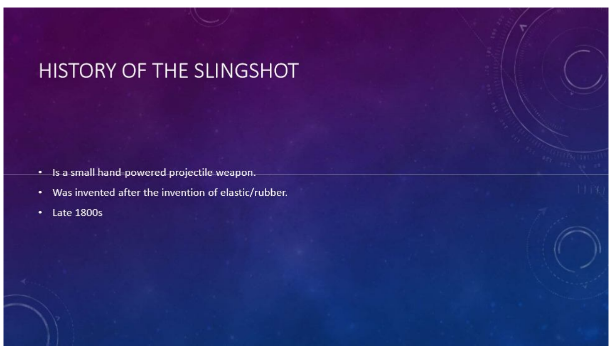

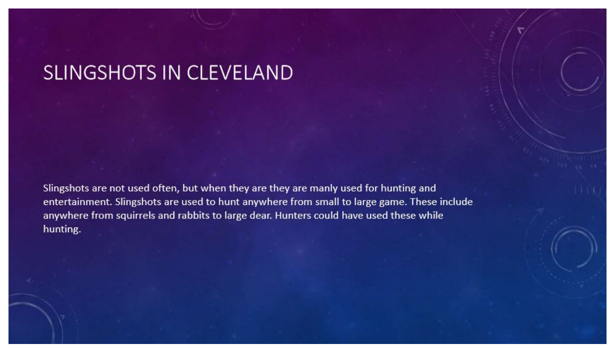

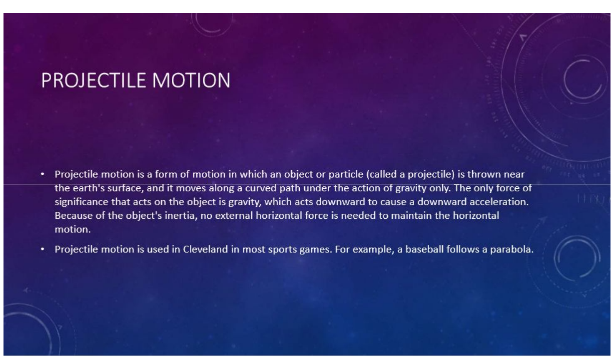

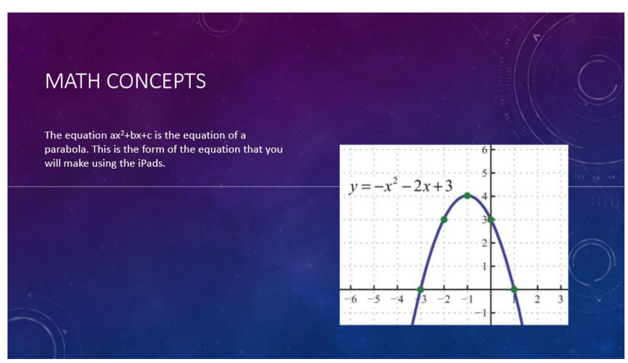

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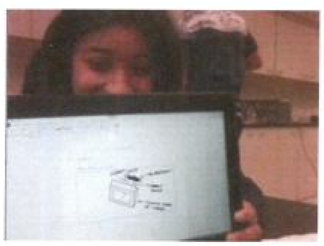

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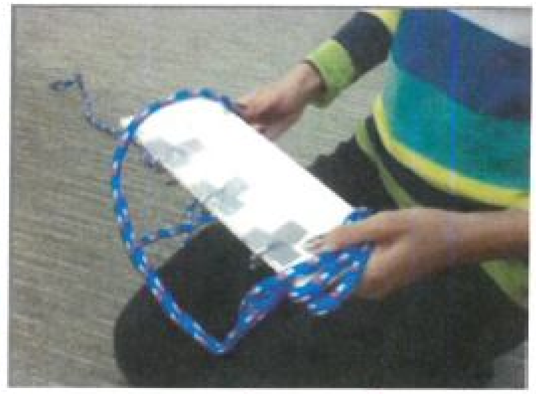

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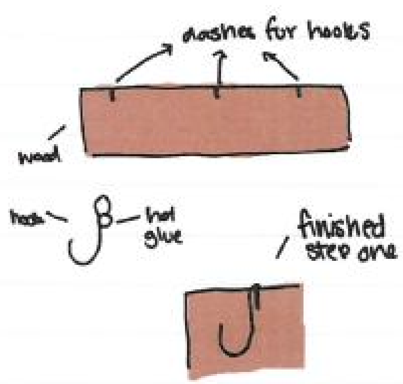

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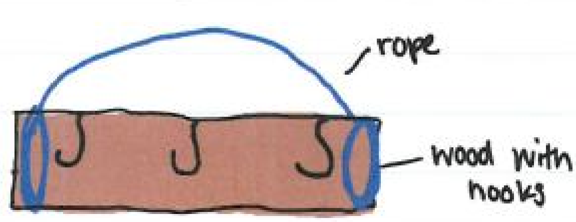

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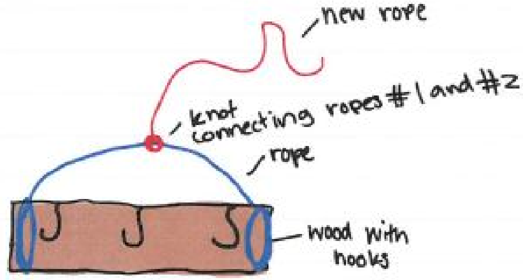
new rope
knot connecting ropes #1 and #2
rope
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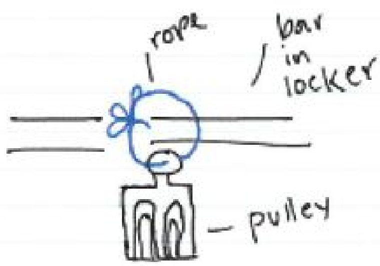
rope
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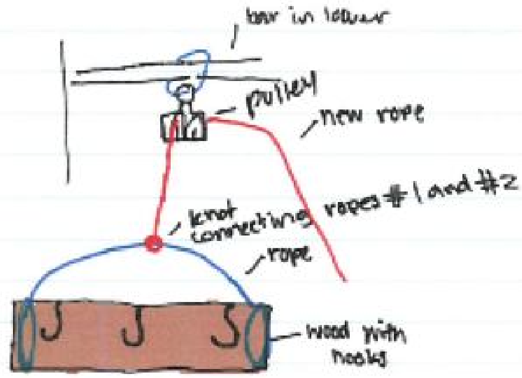
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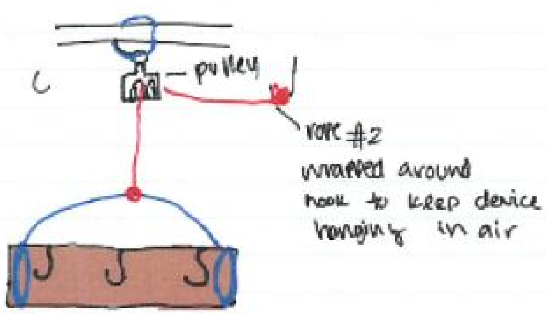
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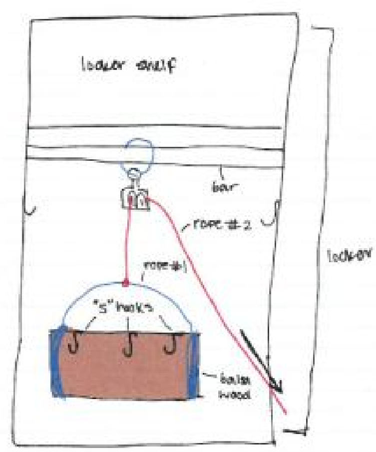
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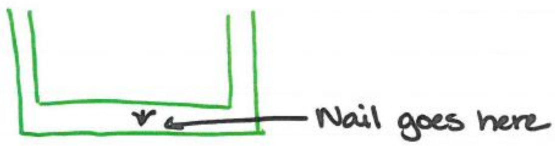

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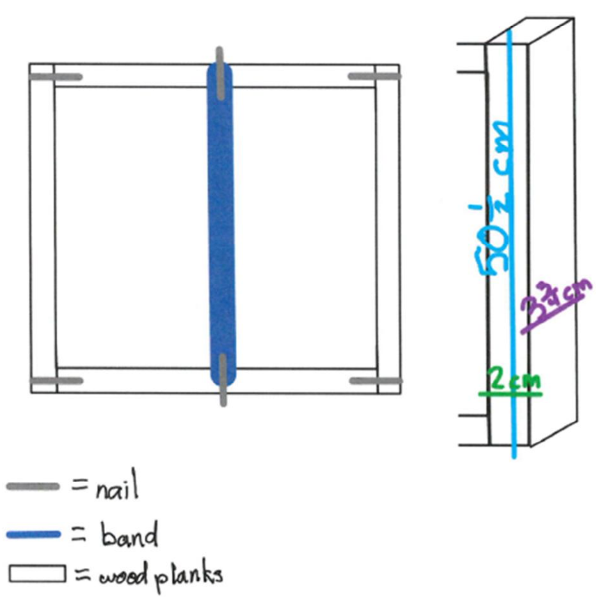

DATA COLLECTION/MATH CONCEPTS TABLE

PART 3: CONSTRUCTION + DATA COLLECTION

Type of machine constructed ~

Projectile B

Task to complete ~

Launching a newspaper B

Data Collection ~

TRAJECTORY LAB DATA TABLES

**** Complete the below with the whole class ****

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Average (t_H)	

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**** Complete the below in your group ****

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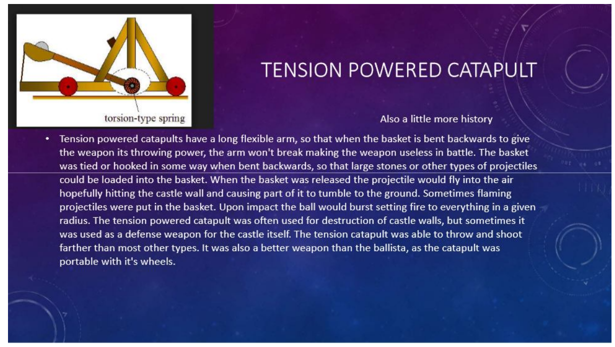

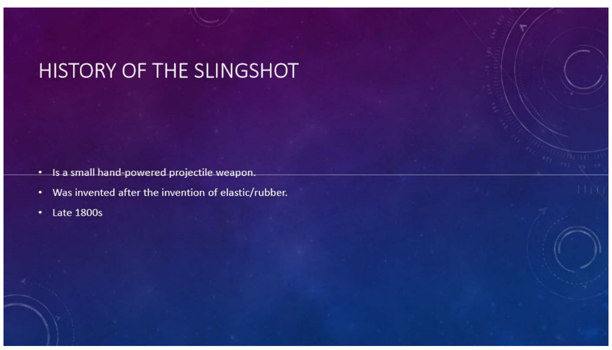

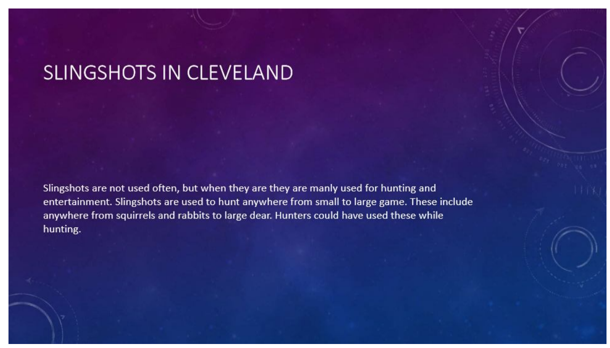

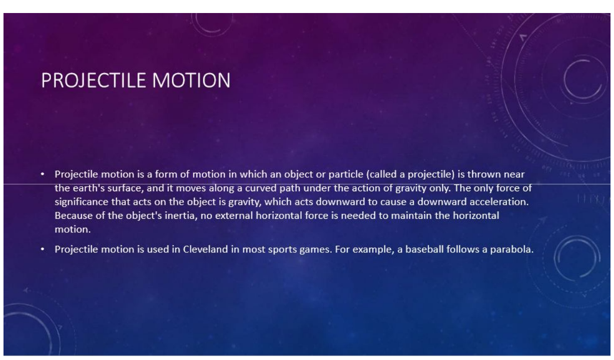

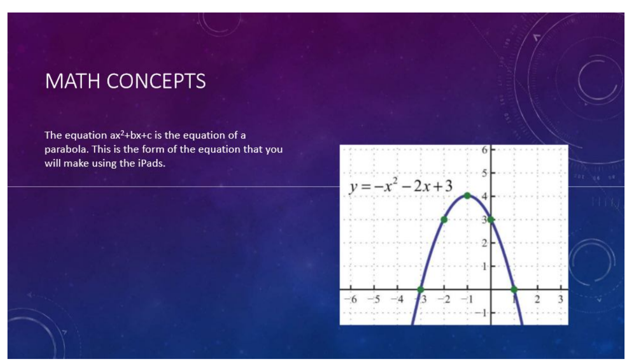

STUDENT EXAMPLES OF PROJECT COMPONENTS

Simple Machines Design Challenge

PHOTO TIMELINES

Design Phase:

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In this step, we came up with the general idea of our catapult, the jobs, and organized our thoughts.

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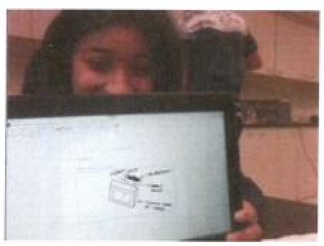

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A locker that was used for reference during the brainstorm process to put our ideas to scale.

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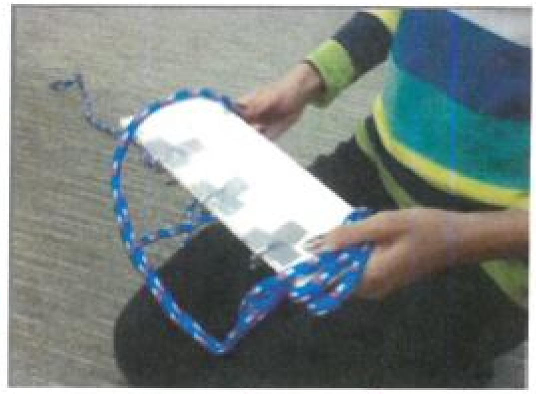

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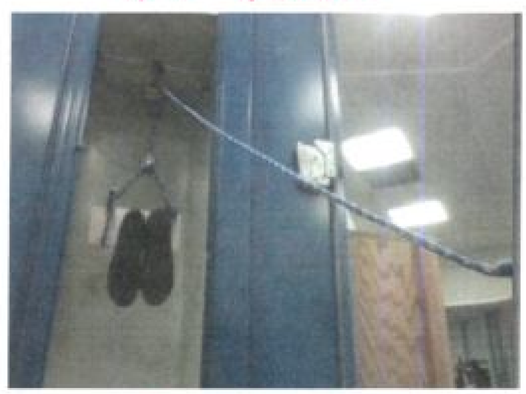

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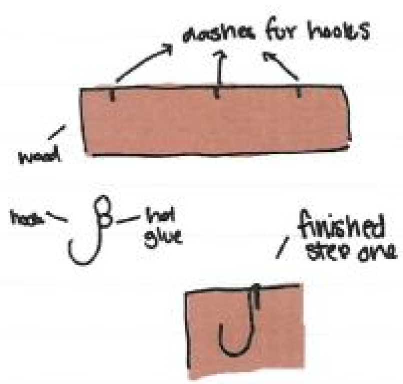

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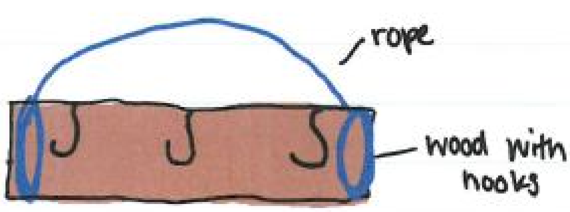

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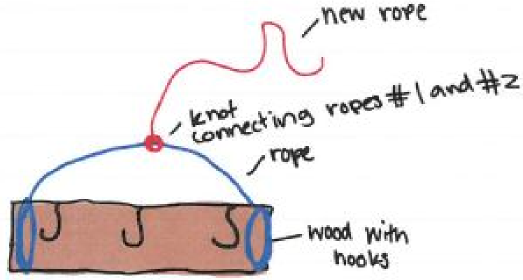
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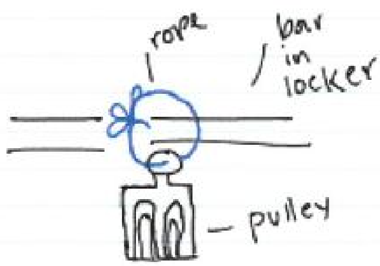
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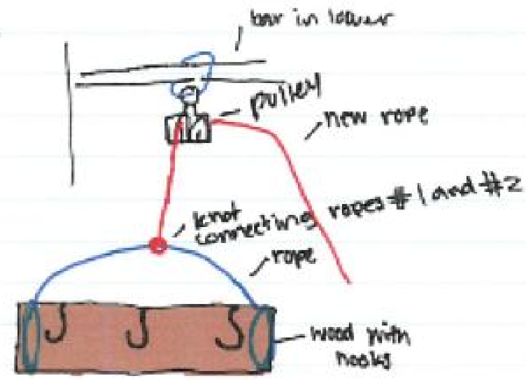
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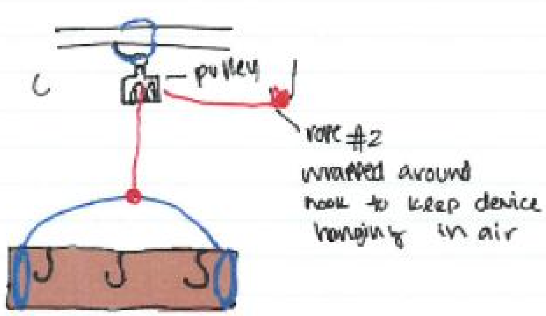
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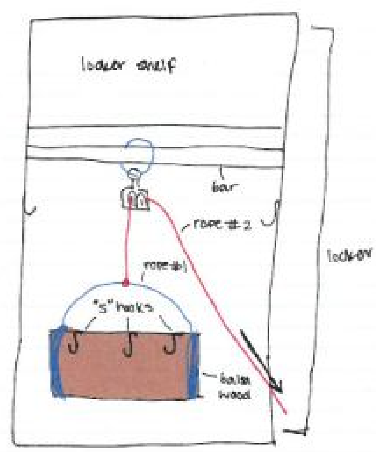
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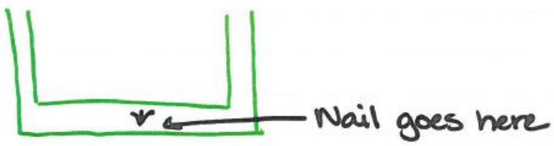

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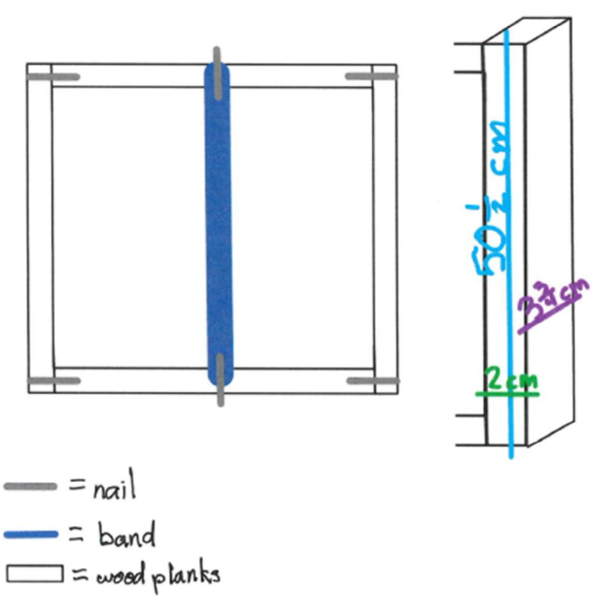

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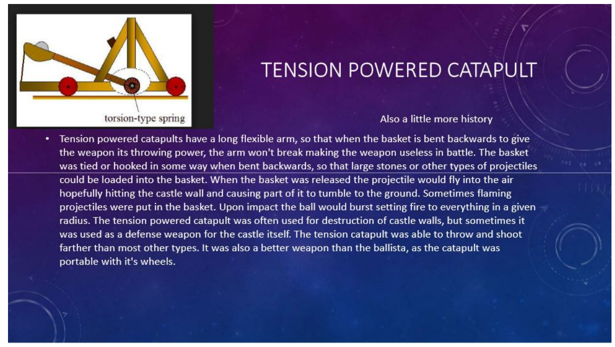

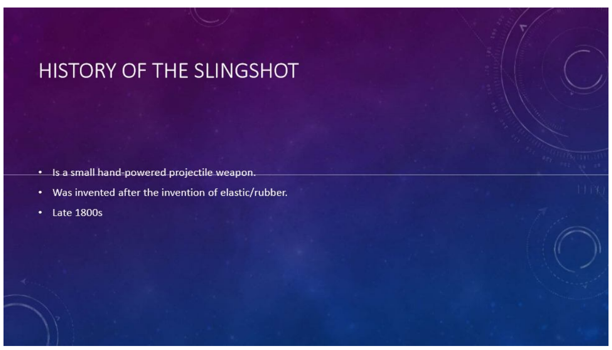

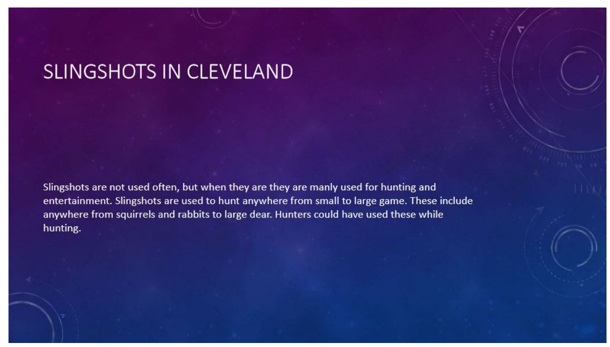

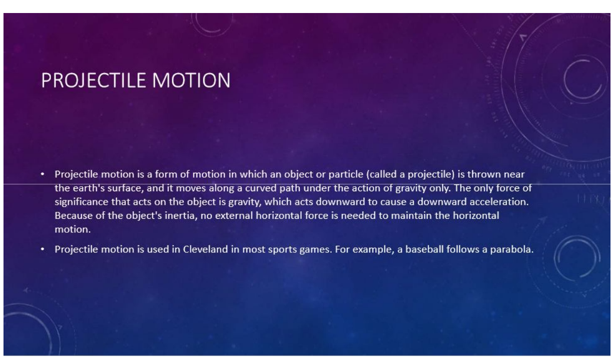

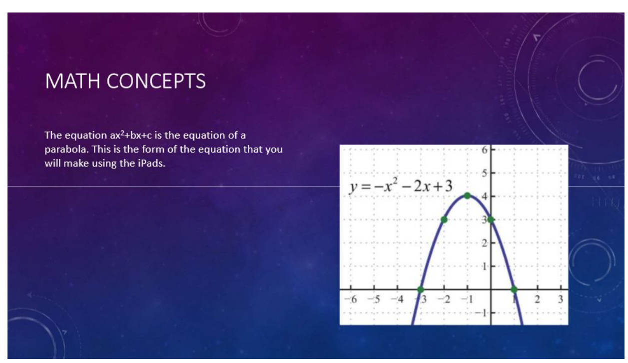

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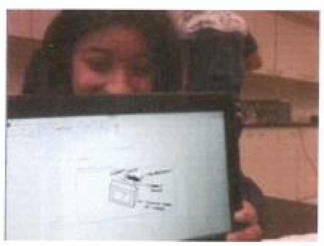

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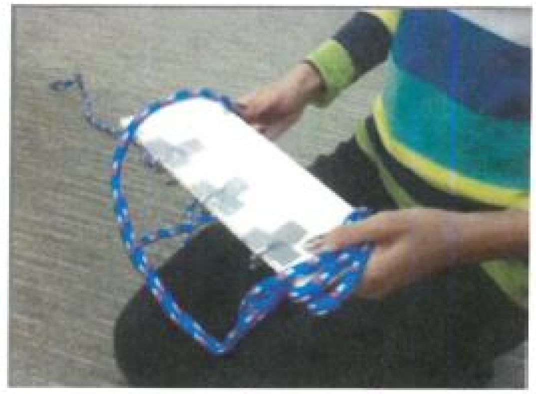

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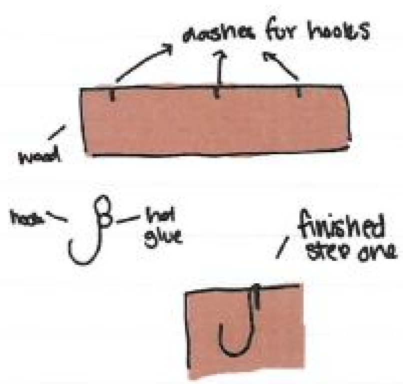

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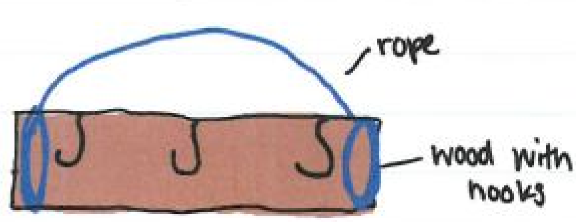

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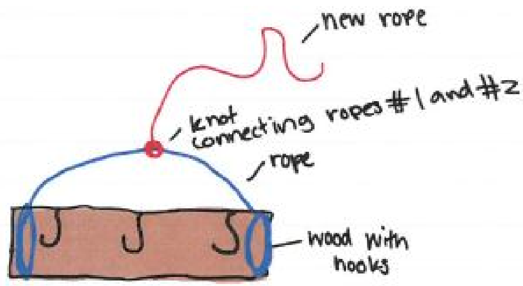
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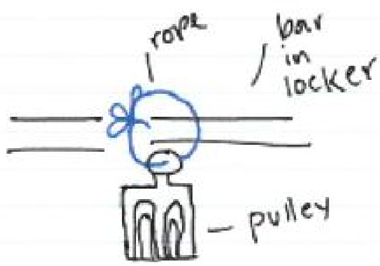
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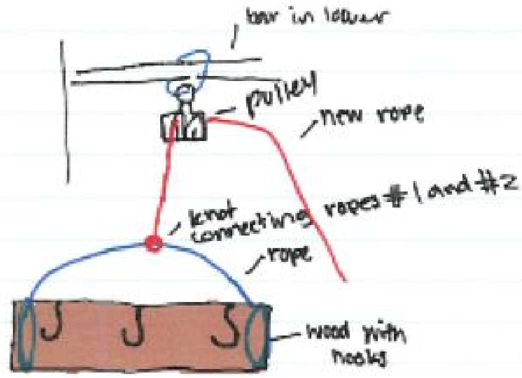
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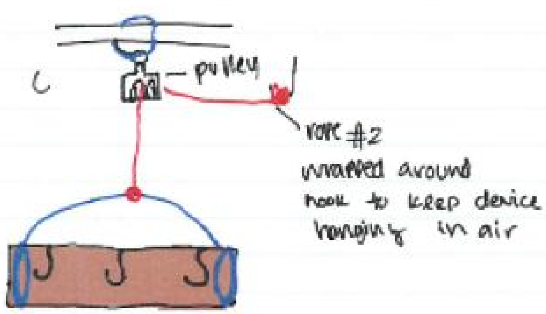
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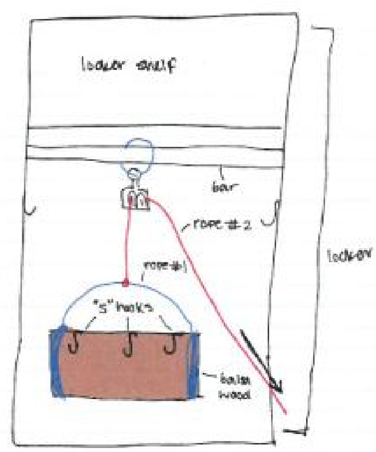
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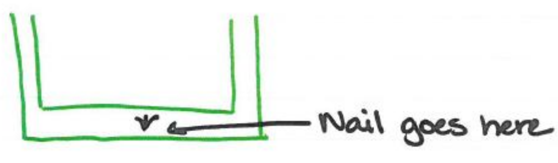

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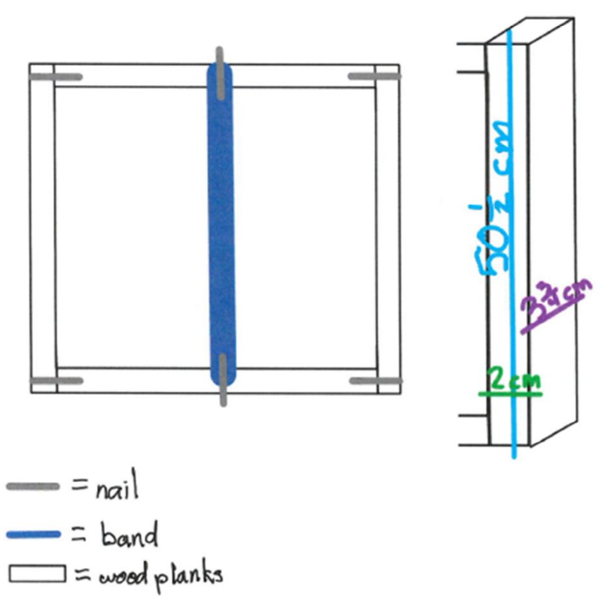

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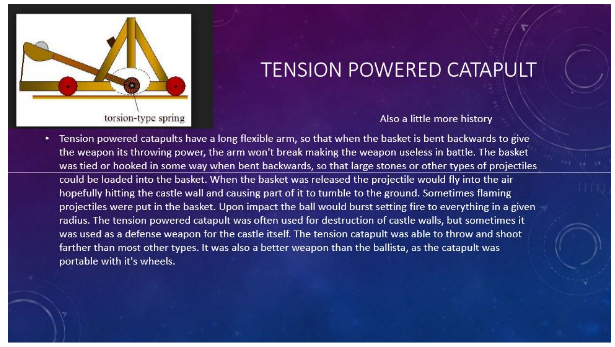

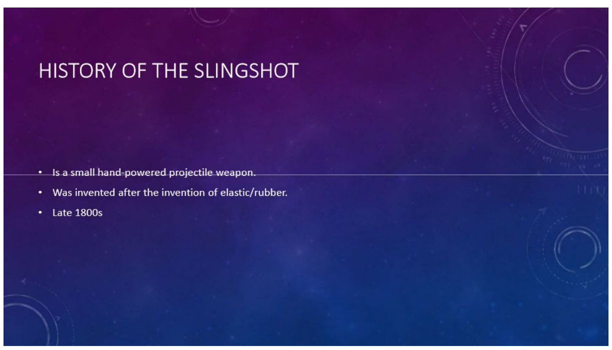

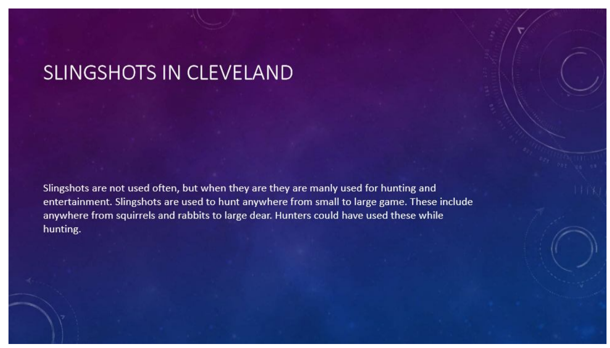

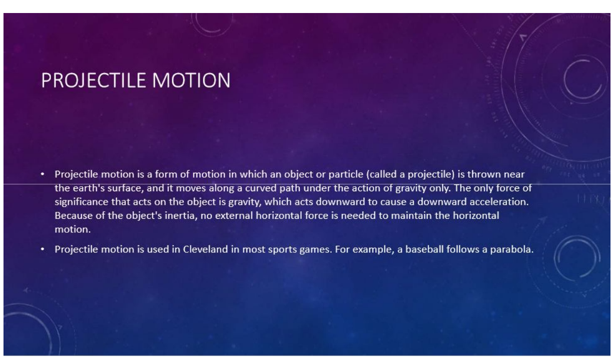

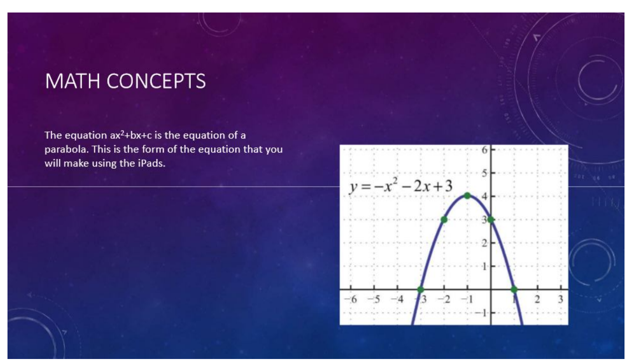

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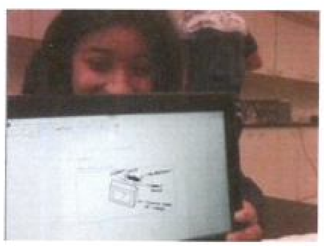

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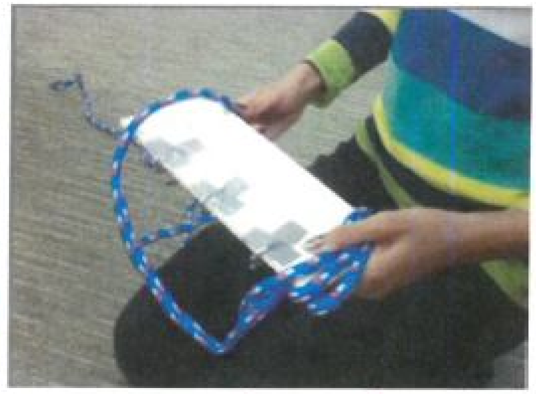

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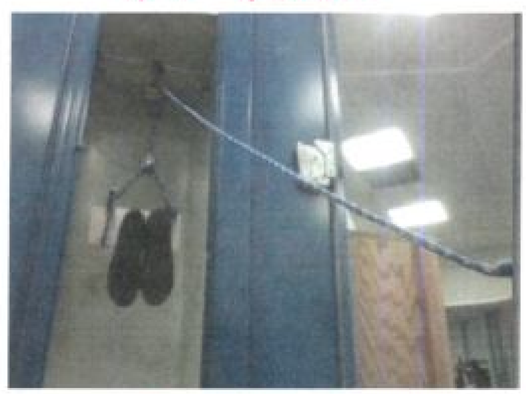

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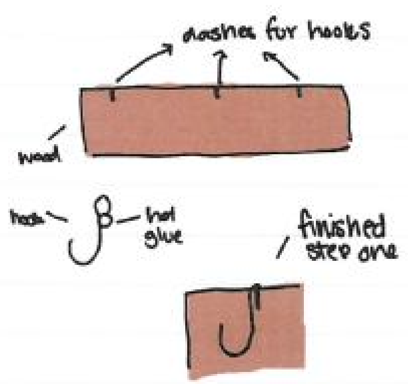

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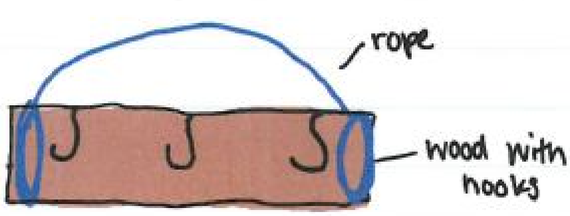

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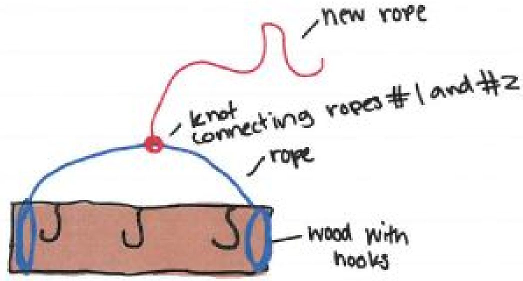
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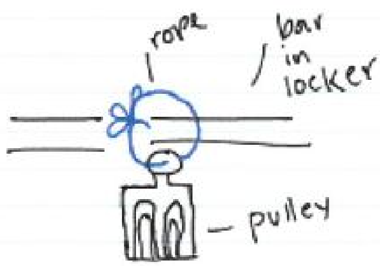
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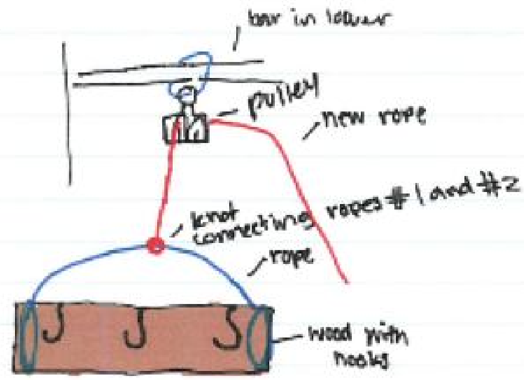
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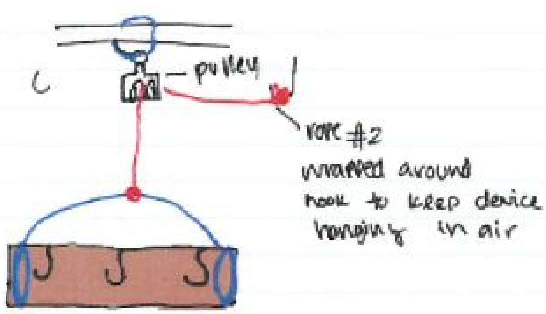
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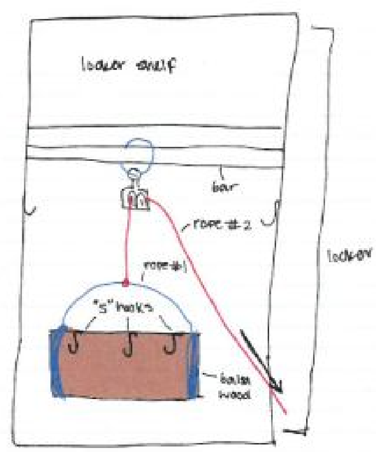
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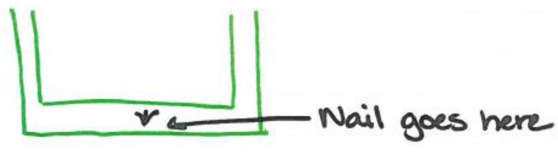

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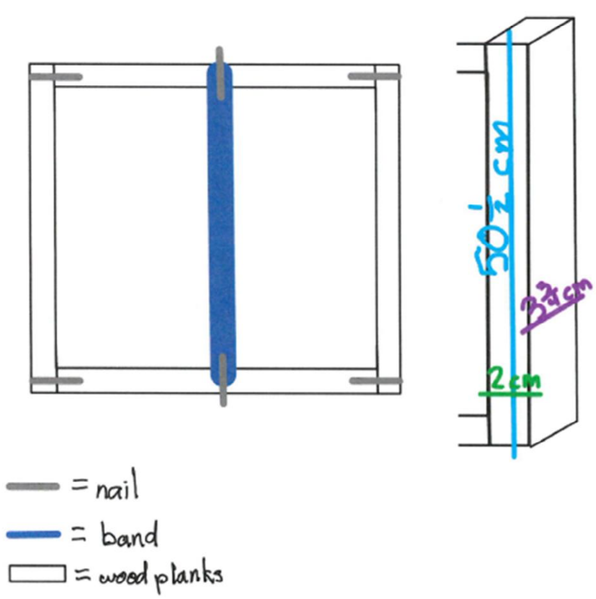

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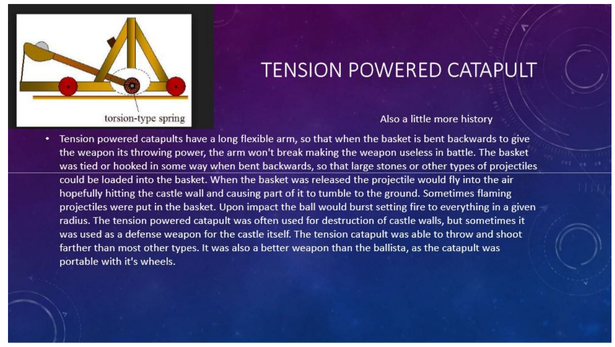

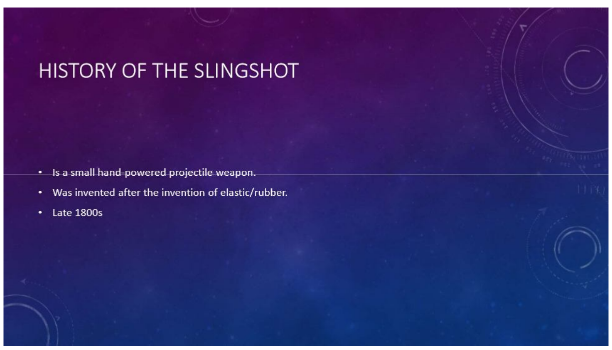

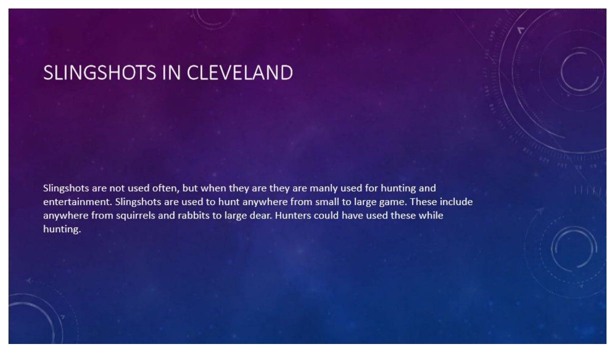

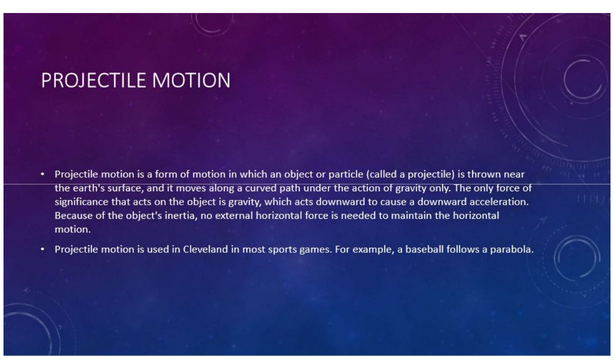

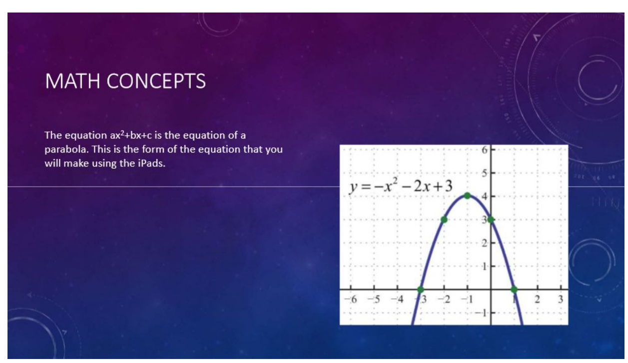

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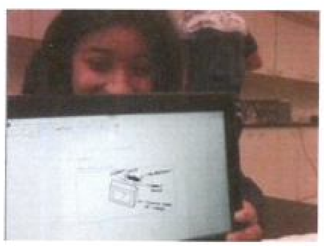

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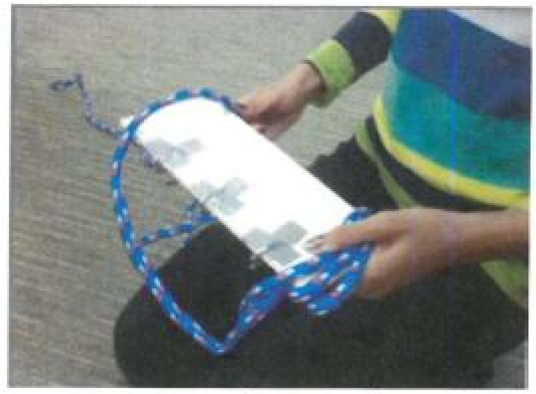

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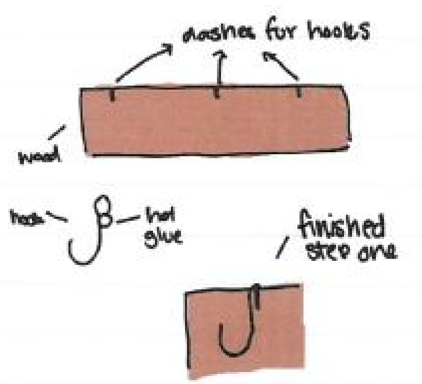

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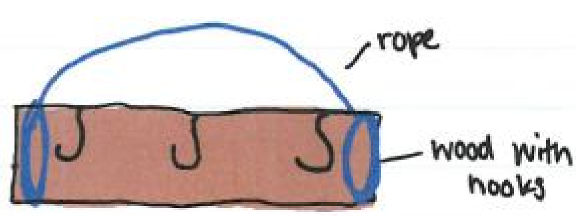

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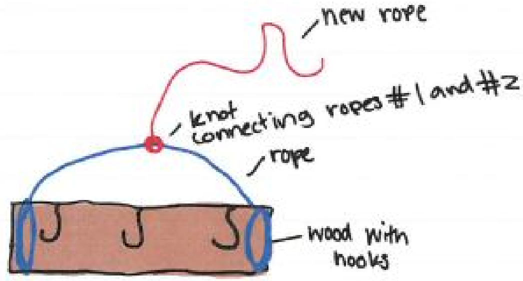
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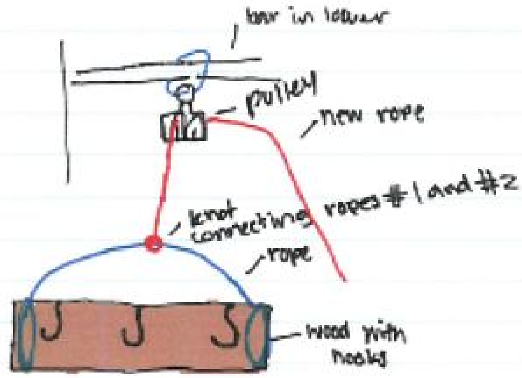
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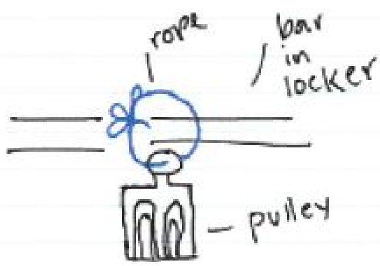
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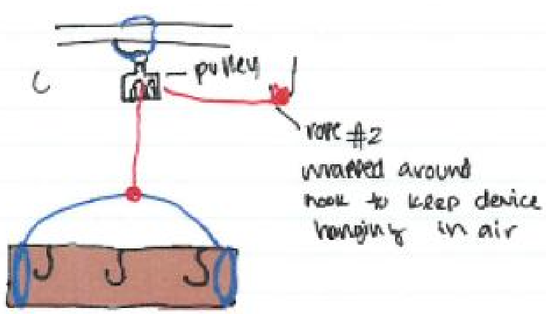
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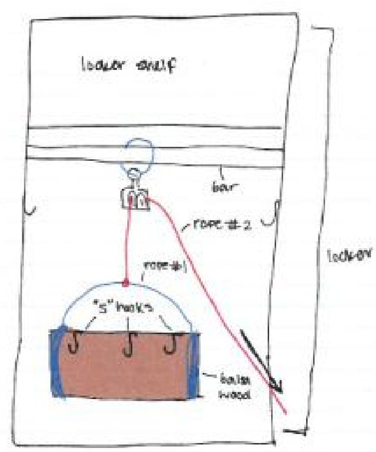
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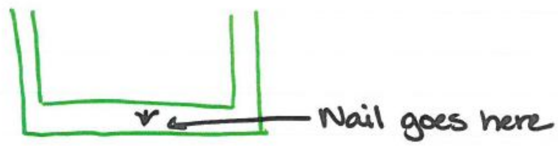

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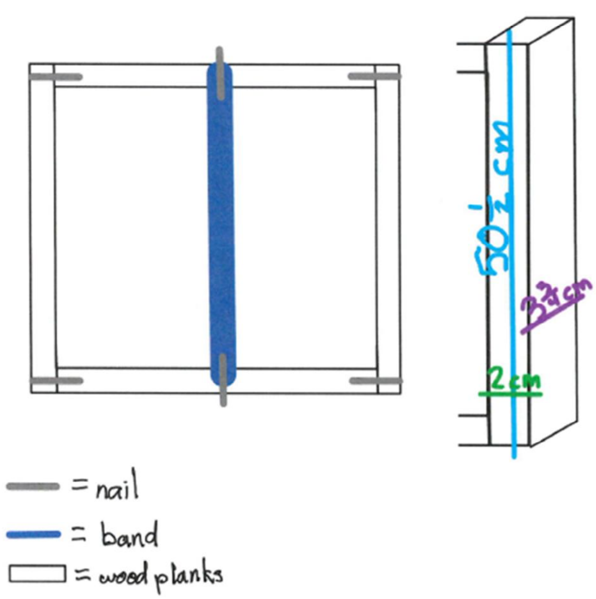

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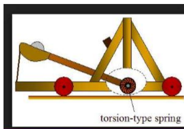
PRESENTATION

HISTORY OF THE CATAPULT

- It was used in the middles ages to help win battles and wars.
- Since castle walls were getting stronger, armies needed something that could break through them.
- Many kinds of catapults were used.
- Some are tension powered, trebuchet, torsion powered, gravity powered, and traction powered.



TENSION POWERED CATAPULT

Also a little more history

- Tension powered catapults have a long flexible arm, so that when the basket is bent backwards to give the weapon its throwing power, the arm won't break making the weapon useless in battle. The basket was tied or hooked in some way when bent backwards, so that large stones or other types of projectiles could be loaded into the basket. When the basket was released the projectile would fly into the air hopefully hitting the castle wall and causing part of it to tumble to the ground. Sometimes flaming projectiles were put in the basket. Upon impact the ball would burst setting fire to everything in a given radius. The tension powered catapult was often used for destruction of castle walls, but sometimes it was used as a defense weapon for the castle itself. The tension catapult was able to throw and shoot farther than most other types. It was also a better weapon than the ballista, as the catapult was portable with it's wheels.

HISTORY OF THE SLINGSHOT

- Is a small hand-powered projectile weapon.
- Was invented after the invention of elastic/rubber.
- Late 1800s

SLINGSHOTS IN CLEVELAND

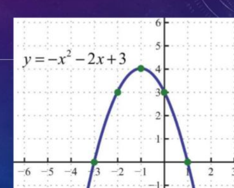
Slingshots are not used often, but when they are they are manly used for hunting and entertainment. Slingshots are used to hunt anywhere from small to large game. These include anywhere from squirrels and rabbits to large dear. Hunters could have used these while hunting.

PROJECTILE MOTION

- Projectile motion is a form of motion in which an object or particle (called a projectile) is thrown near the earth's surface, and it moves along a curved path under the action of gravity only. The only force of significance that acts on the object is gravity, which acts downward to cause a downward acceleration. Because of the object's inertia, no external horizontal force is needed to maintain the horizontal motion.
- Projectile motion is used in Cleveland in most sports games. For example, a baseball follows a parabola.

MATH CONCEPTS

The equation ax^2+bx+c is the equation of a parabola. This is the form of the equation that you will make using the iPads.



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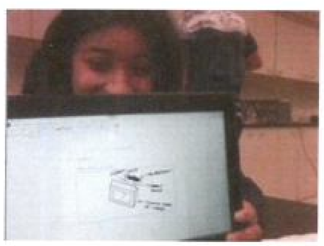

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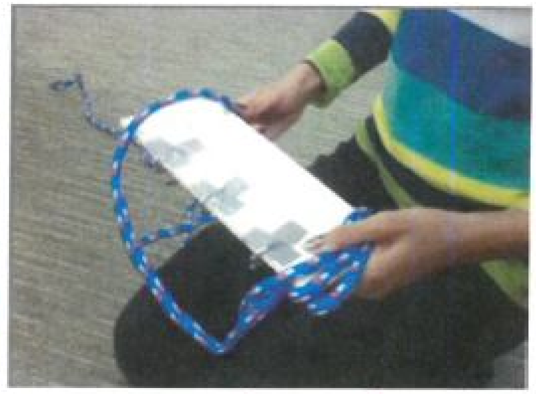

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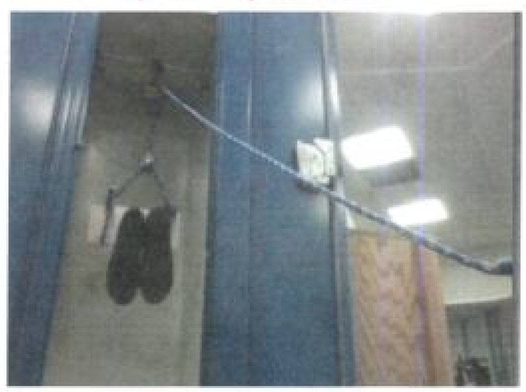

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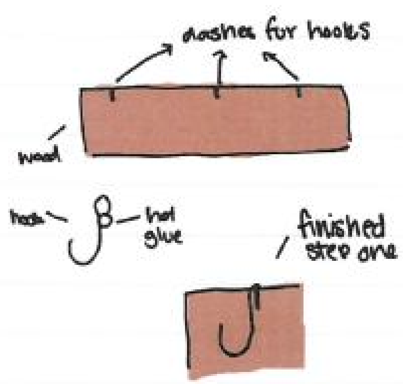

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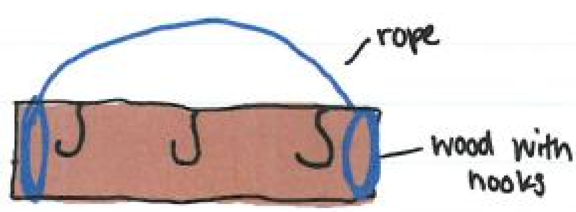

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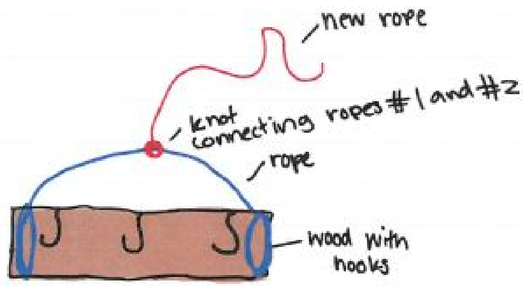
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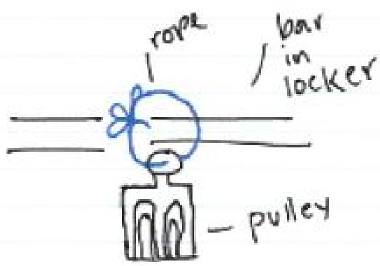
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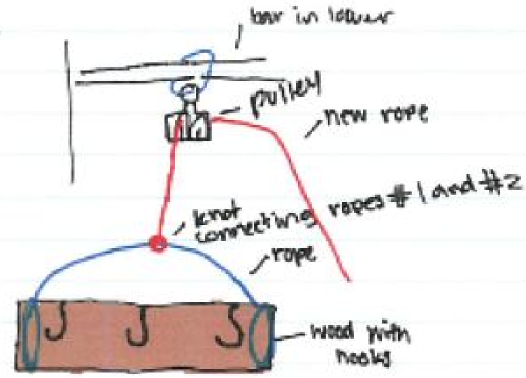
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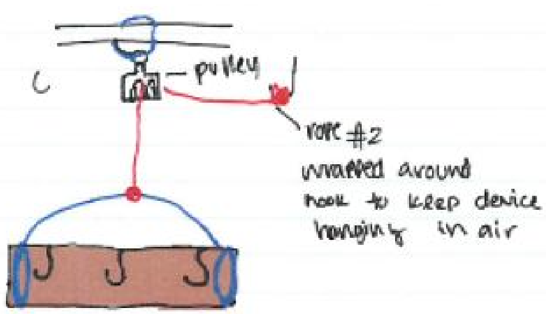
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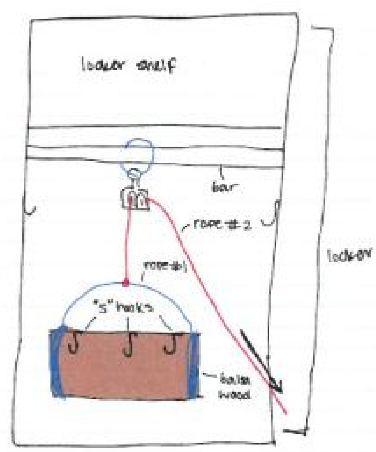
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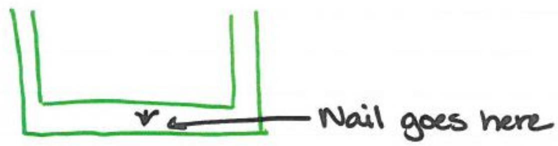

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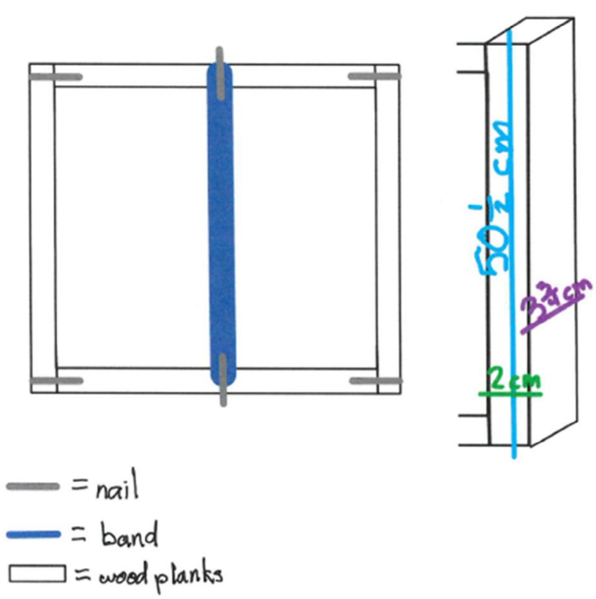

DATA COLLECTION/MATH CONCEPTS TABLE

PART 3: CONSTRUCTION + DATA COLLECTION

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Projectile B

Task to complete ~

Launching a newspaper B

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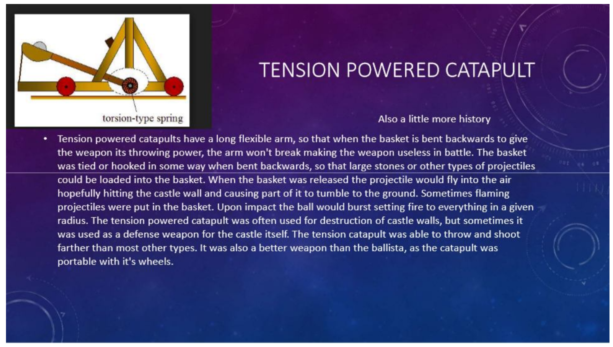

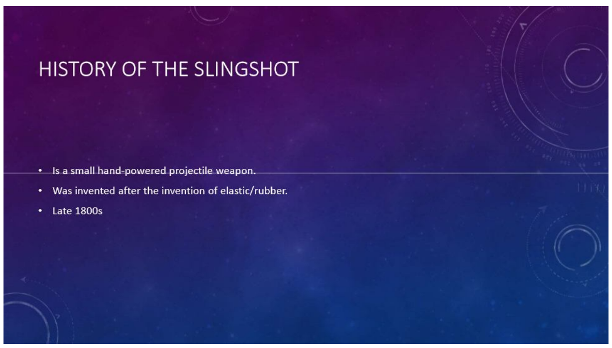

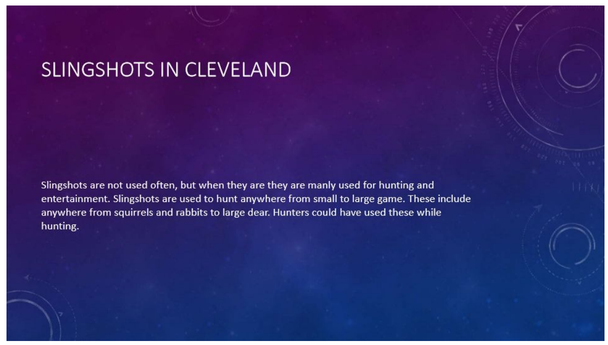

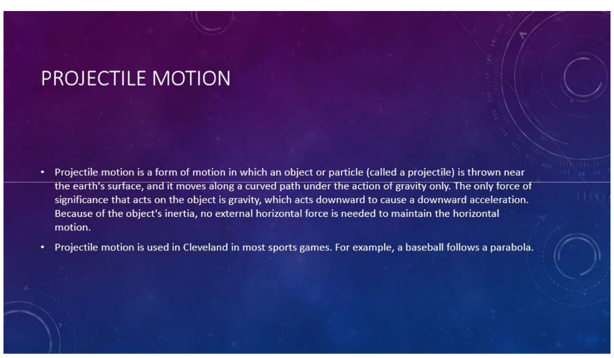

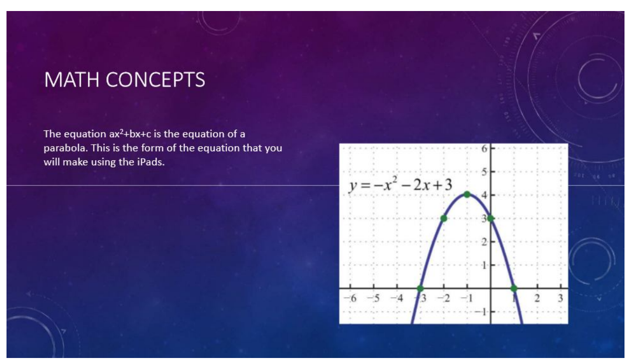

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Simple Machines Design Challenge

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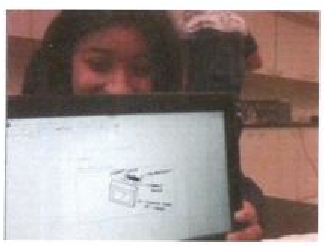

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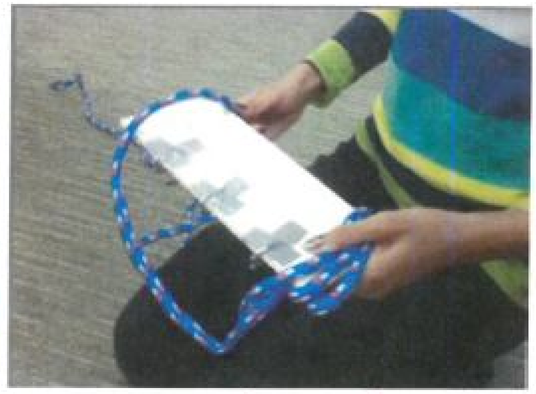

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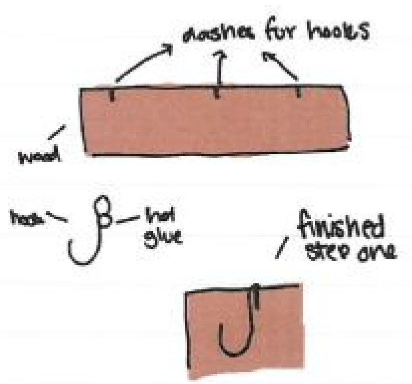

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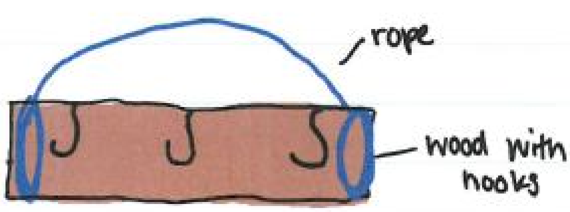

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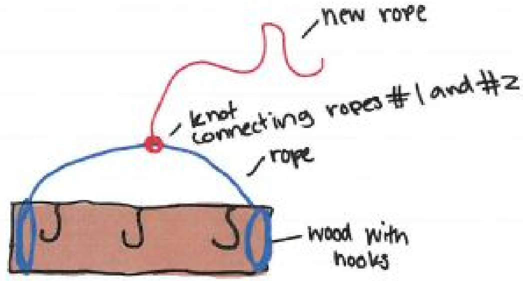
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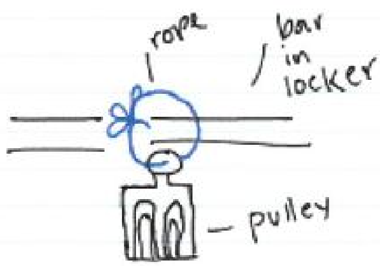
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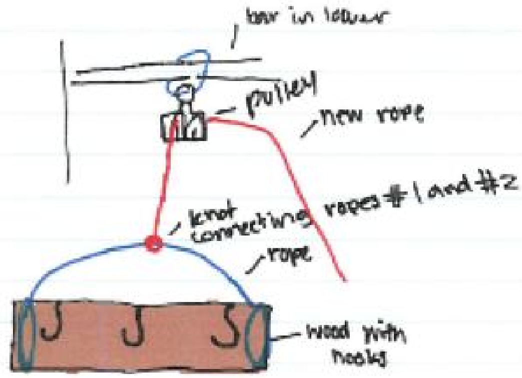
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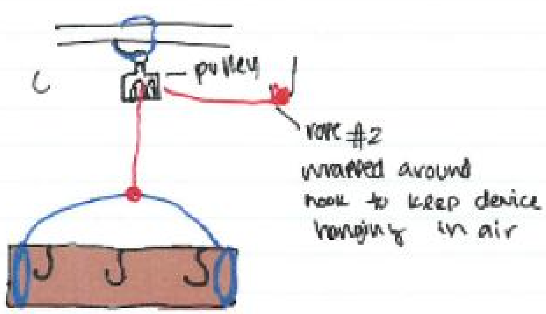
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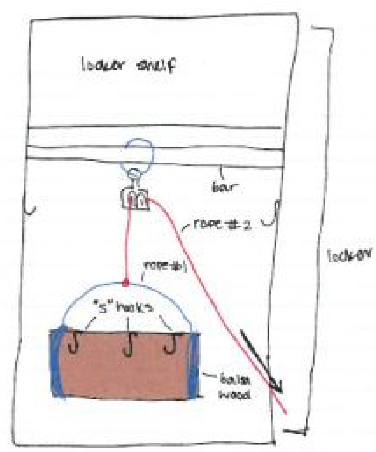
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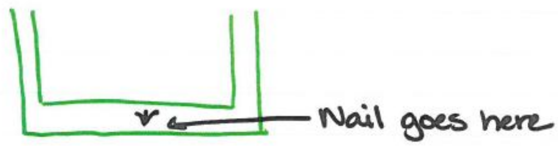

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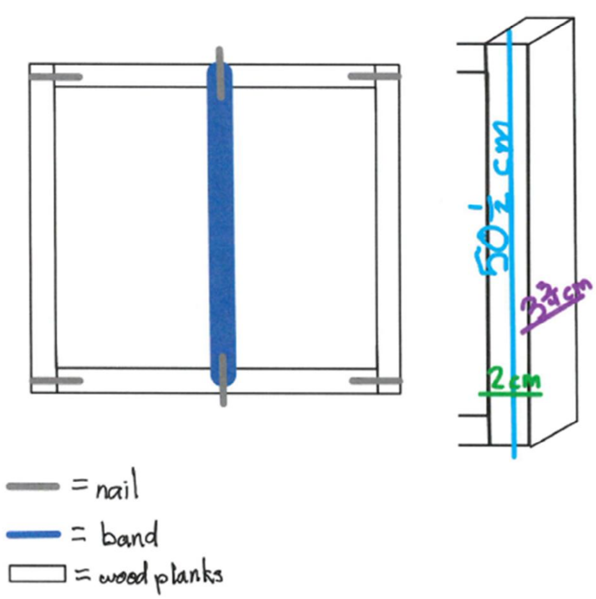

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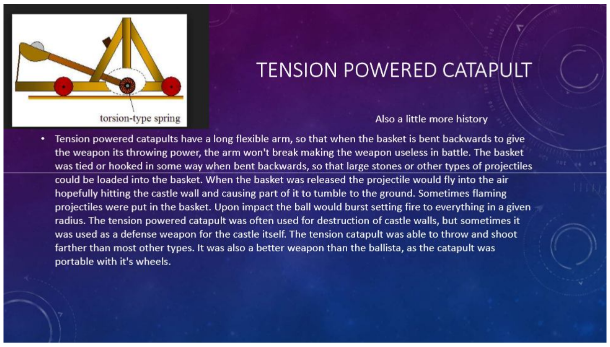

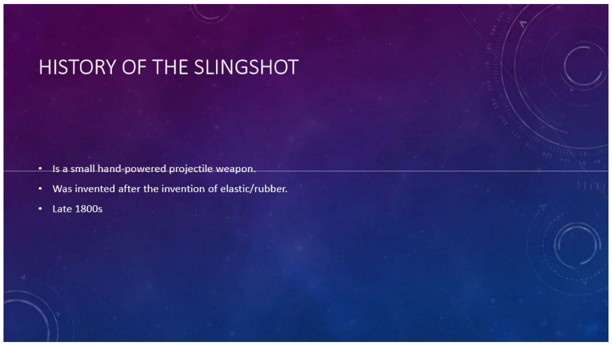

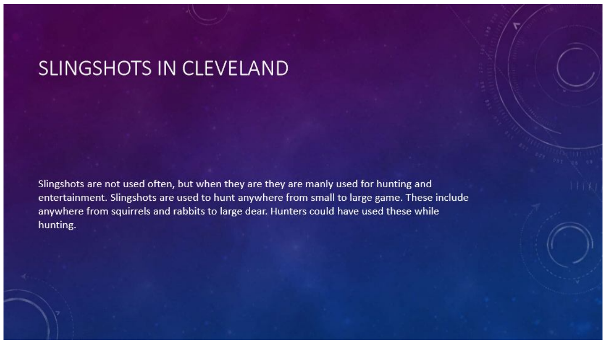

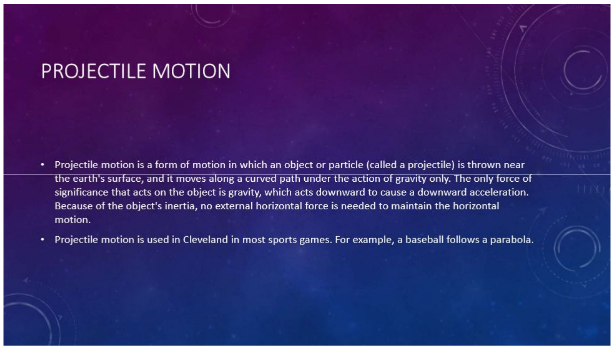

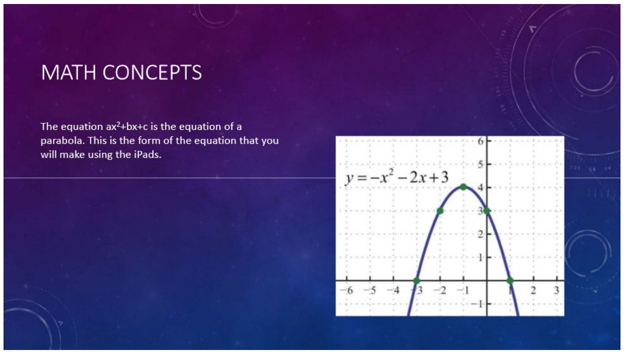

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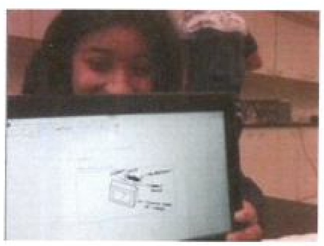

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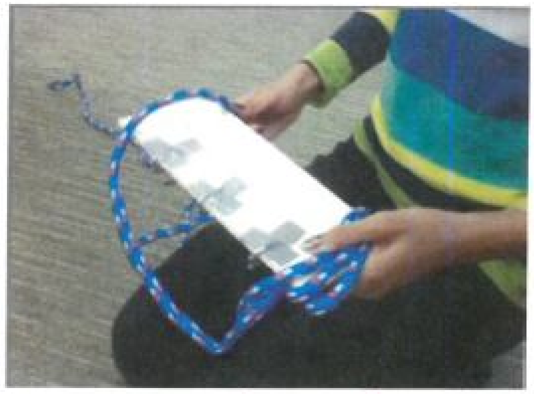

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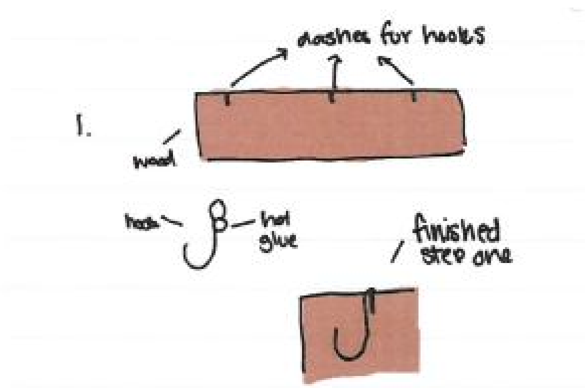

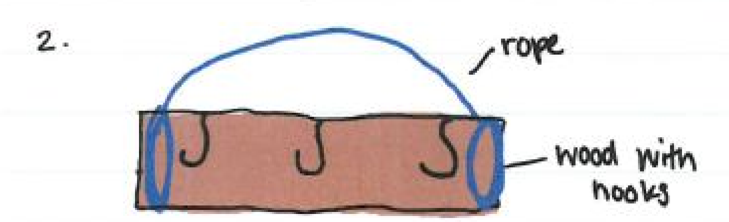

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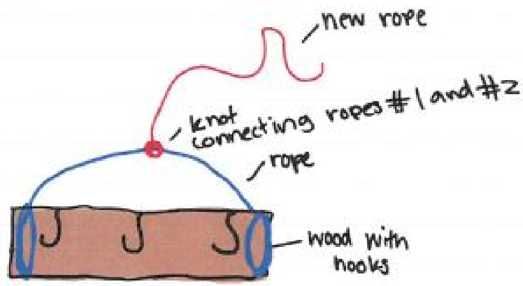
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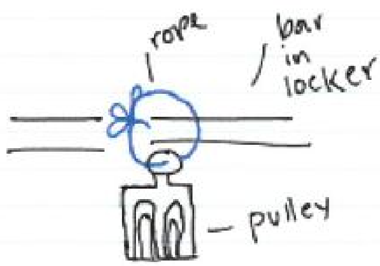
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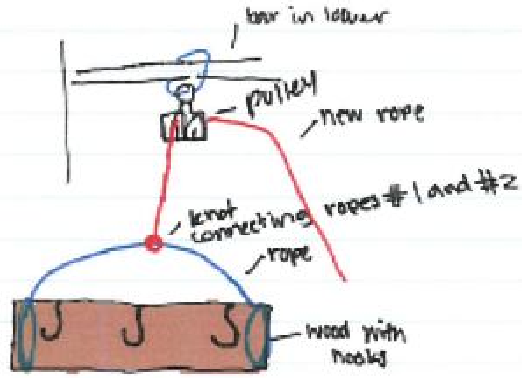
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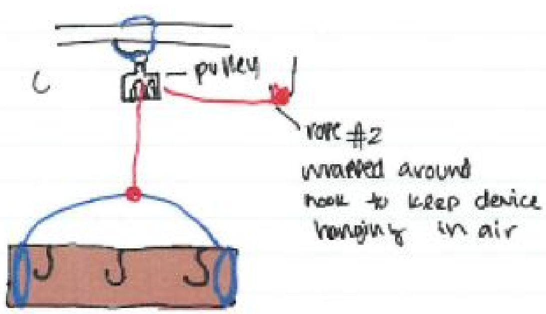
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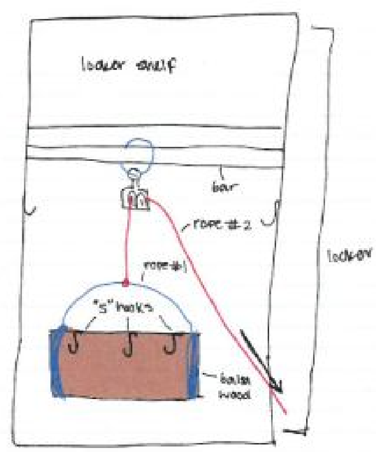
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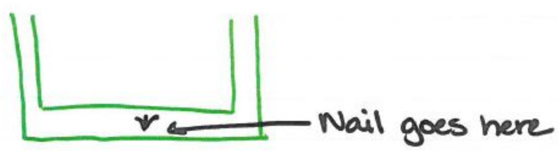

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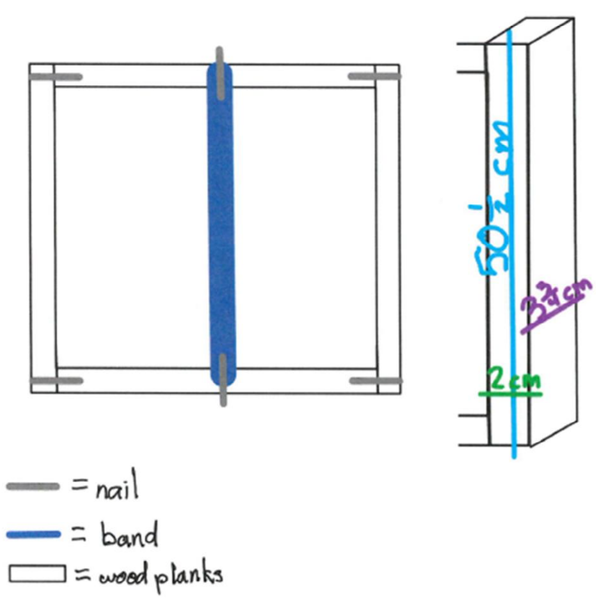

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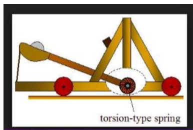
PRESENTATION

HISTORY OF THE CATAPULT

- It was used in the middles ages to help win battles and wars.
- Since castle walls were getting stronger, armies needed something that could break through them.
- Many kinds of catapults were used.
- Some are tension powered, trebuchet, torsion powered, gravity powered, and traction powered.



TENSION POWERED CATAPULT

Also a little more history

- Tension powered catapults have a long flexible arm, so that when the basket is bent backwards to give the weapon its throwing power, the arm won't break making the weapon useless in battle. The basket was tied or hooked in some way when bent backwards, so that large stones or other types of projectiles could be loaded into the basket. When the basket was released the projectile would fly into the air hopefully hitting the castle wall and causing part of it to tumble to the ground. Sometimes flaming projectiles were put in the basket. Upon impact the ball would burst setting fire to everything in a given radius. The tension powered catapult was often used for destruction of castle walls, but sometimes it was used as a defense weapon for the castle itself. The tension catapult was able to throw and shoot farther than most other types. It was also a better weapon than the ballista, as the catapult was portable with it's wheels.

HISTORY OF THE SLINGSHOT

- Is a small hand-powered projectile weapon.
- Was invented after the invention of elastic/rubber.
- Late 1800s

SLINGSHOTS IN CLEVELAND

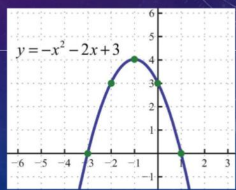
Slingshots are not used often, but when they are they are manly used for hunting and entertainment. Slingshots are used to hunt anywhere from small to large game. These include anywhere from squirrels and rabbits to large dear. Hunters could have used these while hunting.

PROJECTILE MOTION

- Projectile motion is a form of motion in which an object or particle (called a projectile) is thrown near the earth's surface, and it moves along a curved path under the action of gravity only. The only force of significance that acts on the object is gravity, which acts downward to cause a downward acceleration. Because of the object's inertia, no external horizontal force is needed to maintain the horizontal motion.
- Projectile motion is used in Cleveland in most sports games. For example, a baseball follows a parabola.

MATH CONCEPTS

The equation ax^2+bx+c is the equation of a parabola. This is the form of the equation that you will make using the iPads.



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Simple Machines Design Challenge

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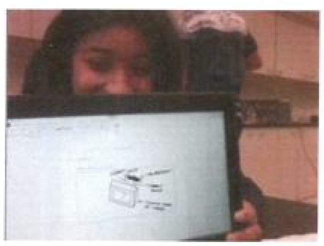

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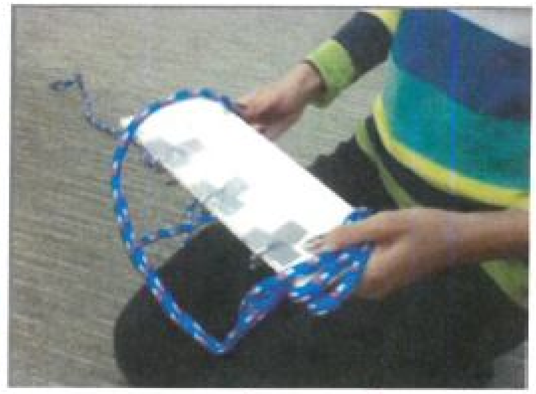

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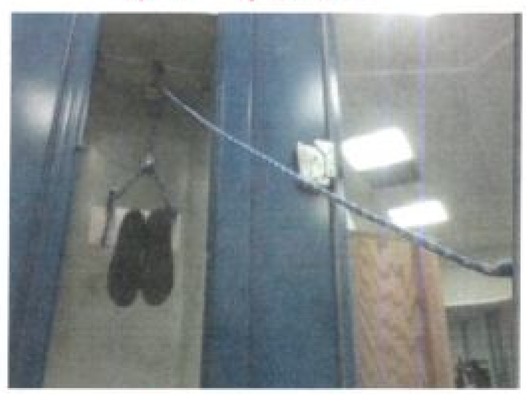

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This is the construction of the wooden frame

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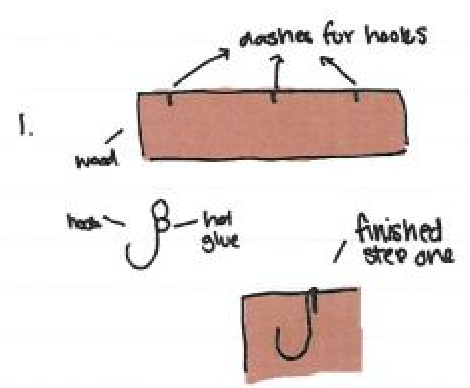

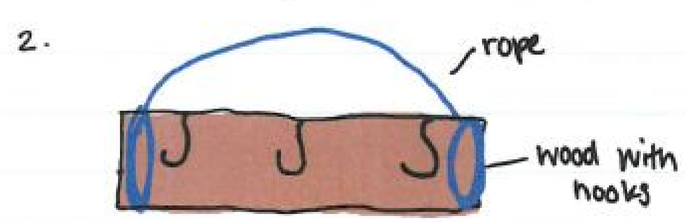

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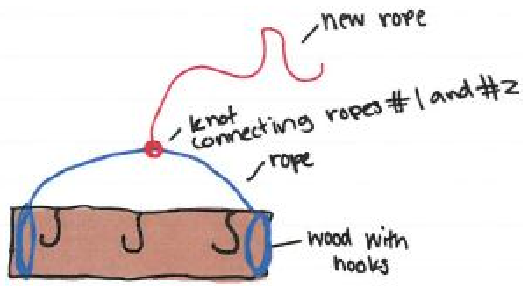
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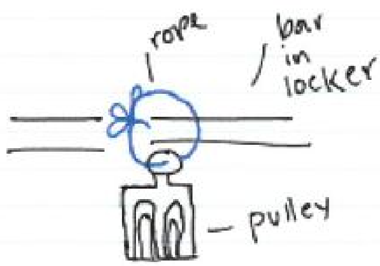
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pulley

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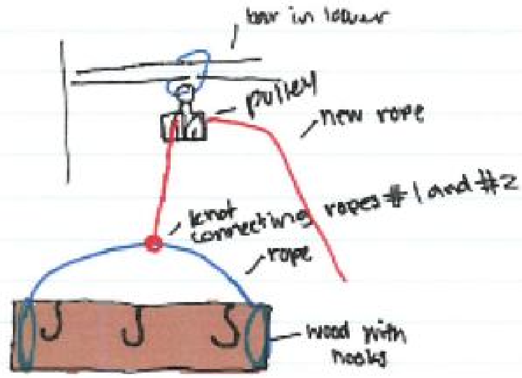
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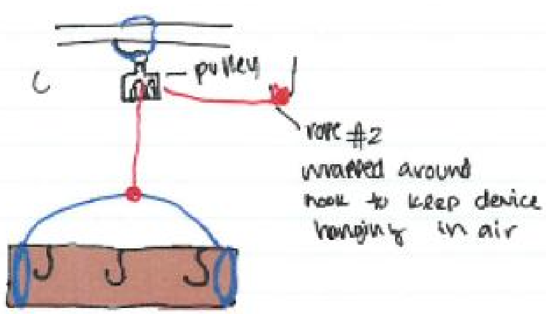
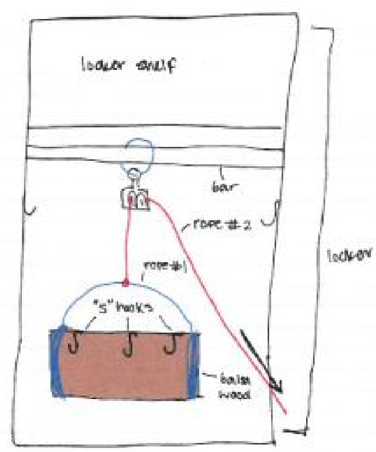

pulley
rope #2 wrapped around hook to keep device hanging in air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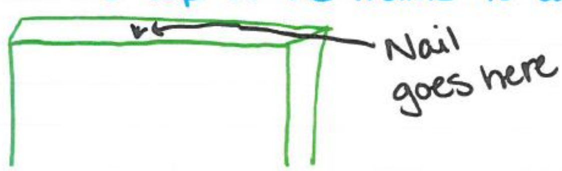

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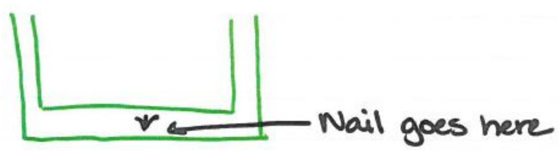

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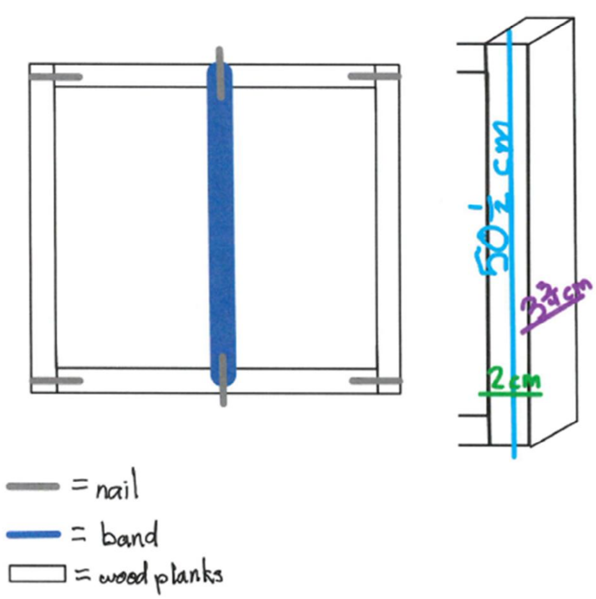

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PART 3: CONSTRUCTION + DATA COLLECTION

Type of machine constructed ~

Projectile B

Task to complete ~

Launching a newspaper B

Data Collection ~

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**** Complete the below with the whole class ****

Horizontal Time:

Trial	Time for dart to travel 6m horizontally (seconds)
1	N/A
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3	
Average (t_H)	

Horizontal Velocity (V_H): ______________ m/sec

**** Complete the below in your group ****

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!!!!! This is the distance away from your firer you should place your target!

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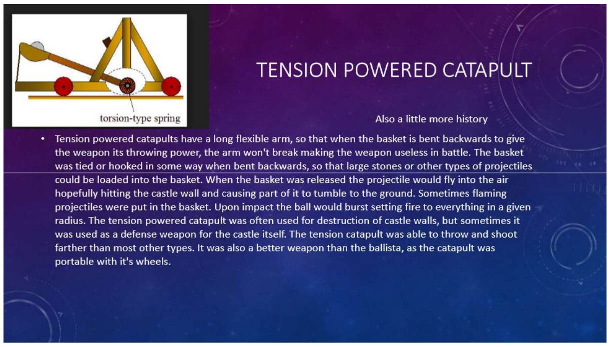

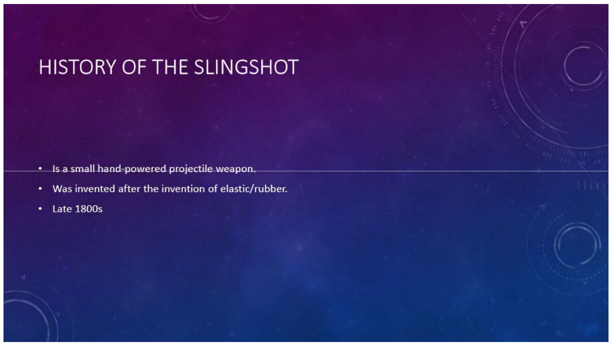

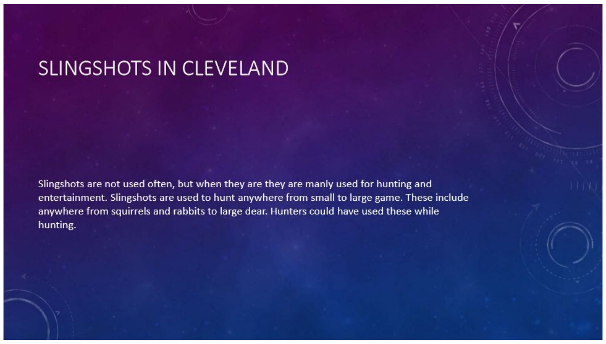

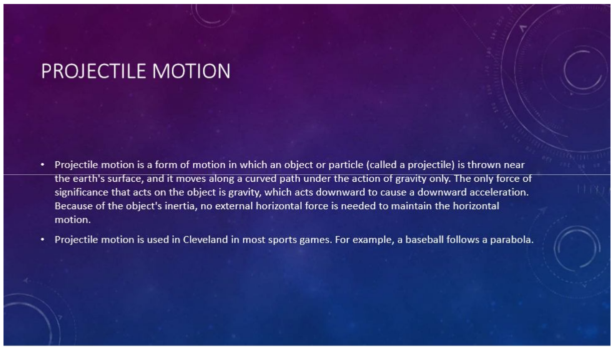

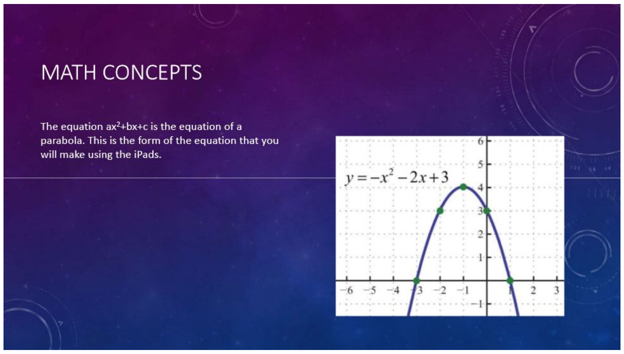

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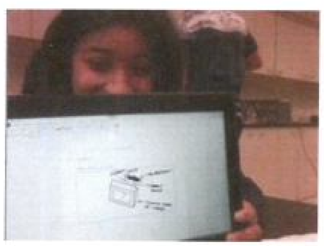

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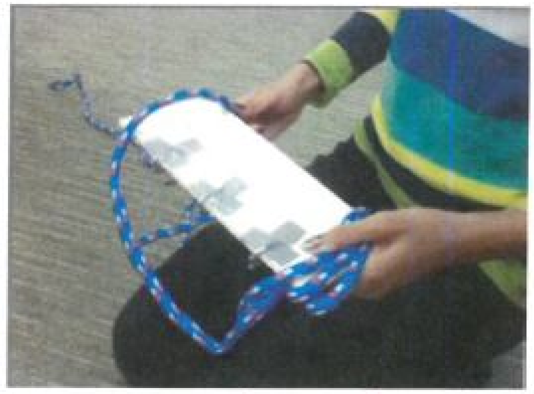

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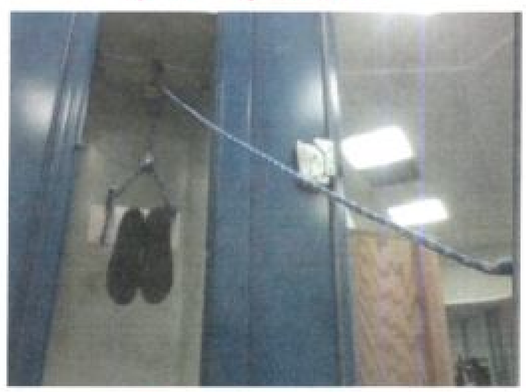

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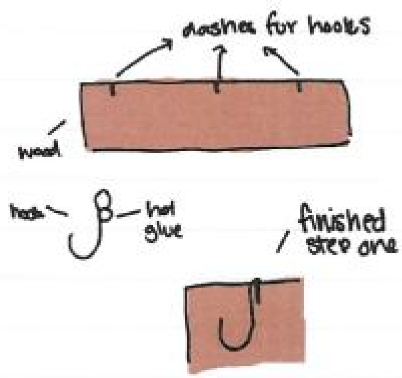

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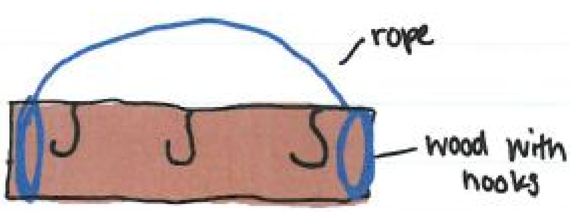

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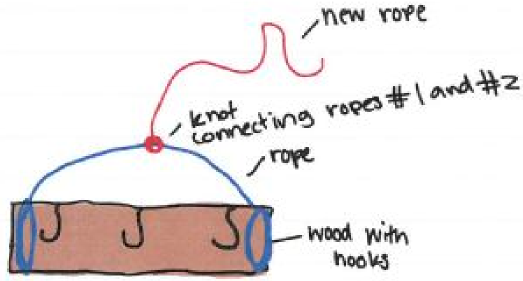
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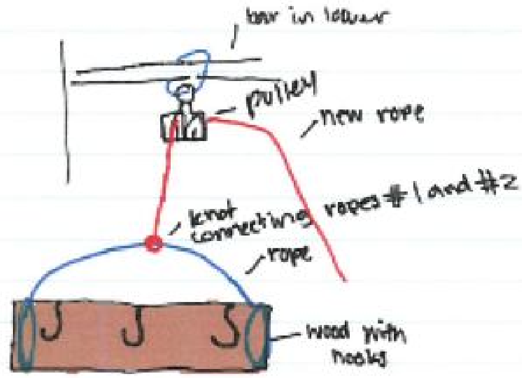
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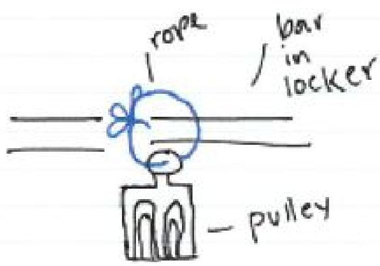
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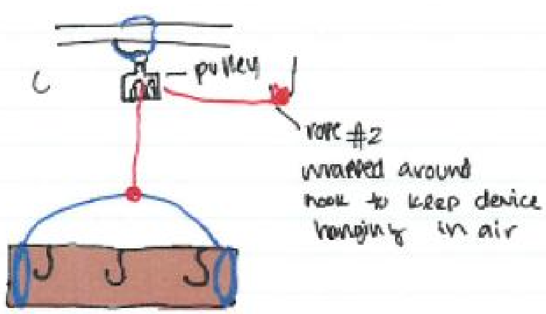
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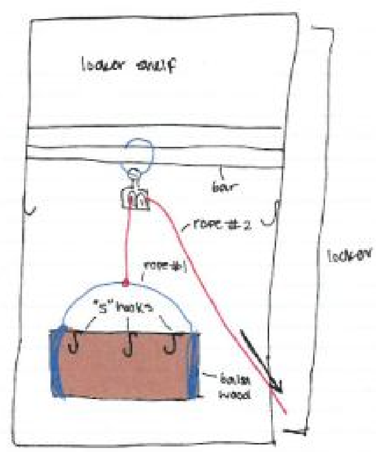
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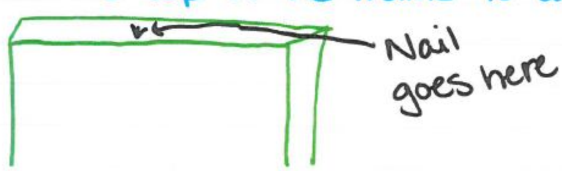

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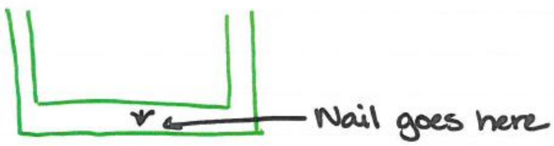

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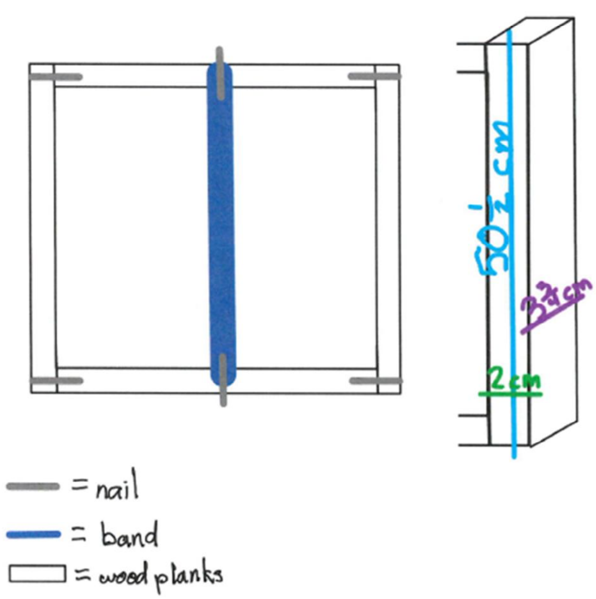

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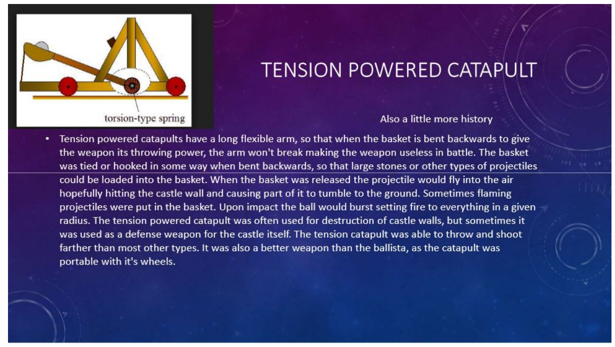

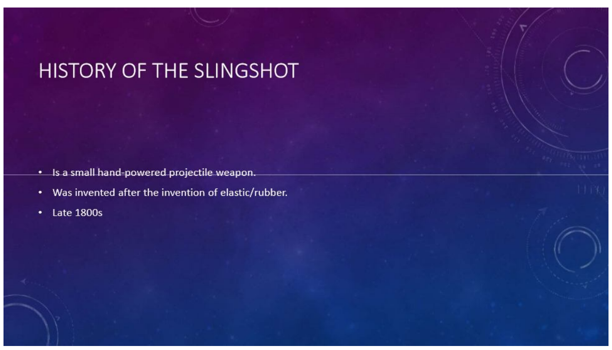

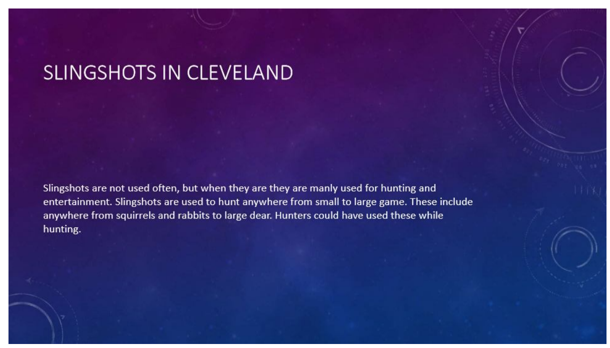

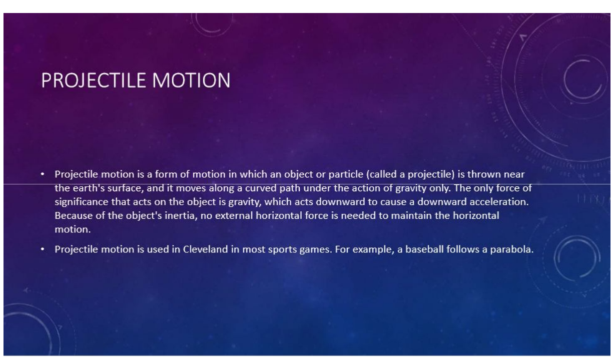

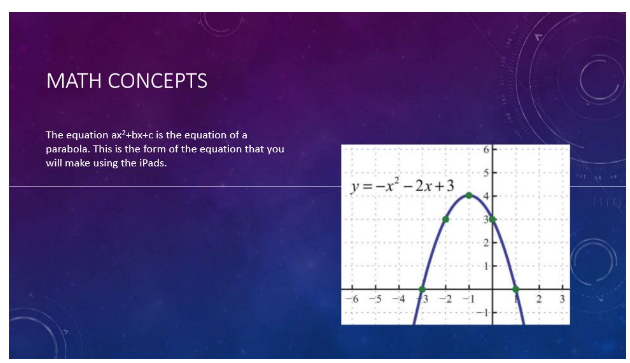

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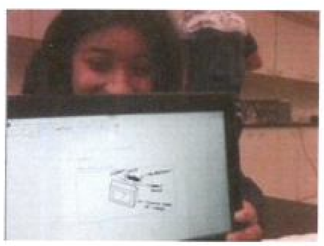

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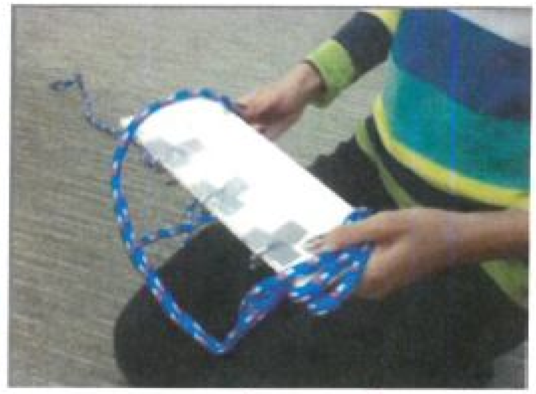

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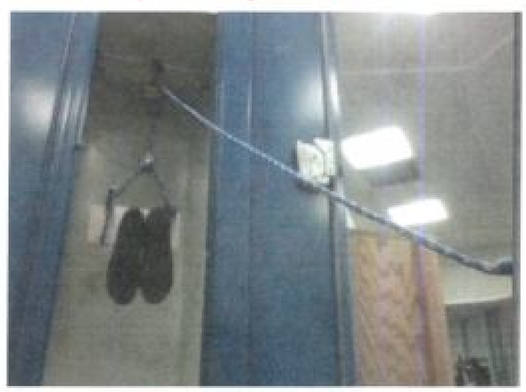

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The group deciding which way to hold the newspaper well launching it.

Jay testing out how the slingshot will work.

SUPPLY LIST & BUDGET

DESCRIPTION OF ITEMS TO BE BOUGHT AT ~~LOWES~~ Ace	ACEHARDWARE.COM ITEM NUMBER	UNIT PRICE	QUANTITY	TOTAL COST
3 20" wood pieces square piece from class			4	
3 nails			4	
hammer ✓			1	
elastic band ✓			1-2	
1 of the screwable rectangles✓			1	
leather band ✓			1	
			TOTAL COST:	

DESIGN & CONSTRUCTION DETAILS

Instructions & Diagrams:

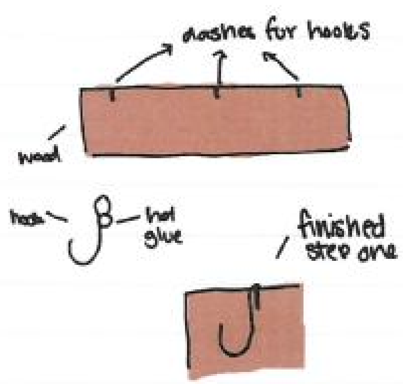
~Locker Pulley~

1. Hot glue the hooks on to the wood where the dashes indicate. See picture one.
2. Tightly wrap one piece of rope to either end of the wood, leaving excess rope in the middle loose. See picture two.
3. Tie another rope to the excess loose rope. See picture three.
4. Put the smaller rope through the hole at the top of the pulley and around the bar in your locker. Connect the two ends and hot glue them together.
5. Put rope number two through the pulley, creating a pulley system. See picture four.
6. Attach desired items onto hooks and utilize this simple machine!

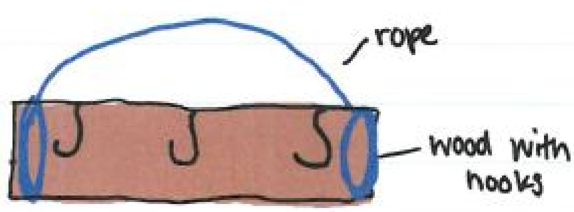
****NOTE****

Once the item has been pulled to hang in the air to the desired height, wrap the pulled end of the rope around one of the locker hooks to keep your items in place. See picture five for reference.

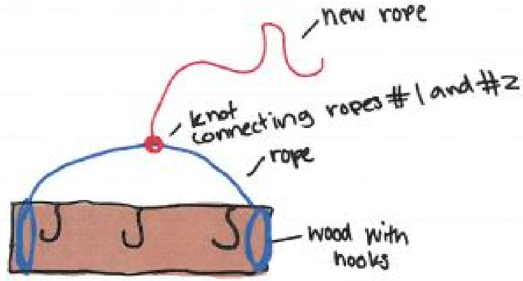
1.



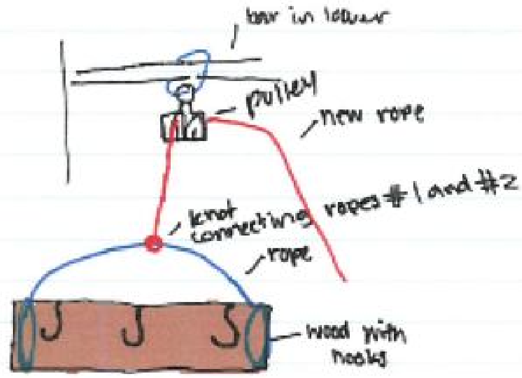
2.



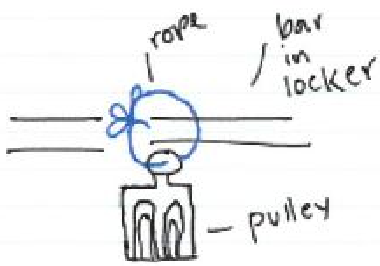
3.


new rope
knot connecting ropes #1 and #2
rope
wood with hooks

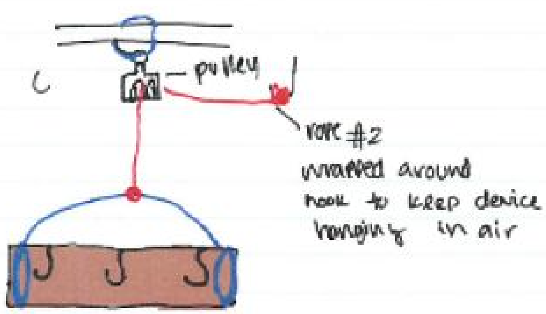
5.

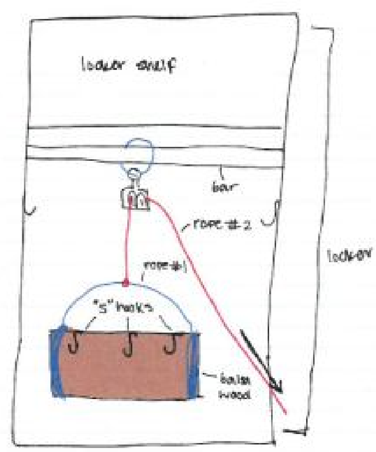

bar in locker
pulley
new rope
knot connecting ropes #1 and #2
rope
wood with hooks

4.


rope
bar in locker
pulley

6.


pulley
rope #2
wrapped around
hook to keep device
hanging in air

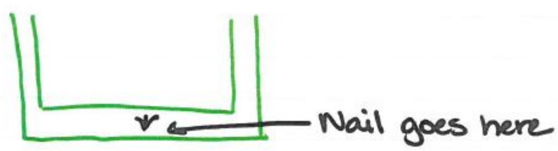

locker shelf
bar
rope #2
rope #1
"S" hooks
balsa wood
locker

~Projectile Launcher~

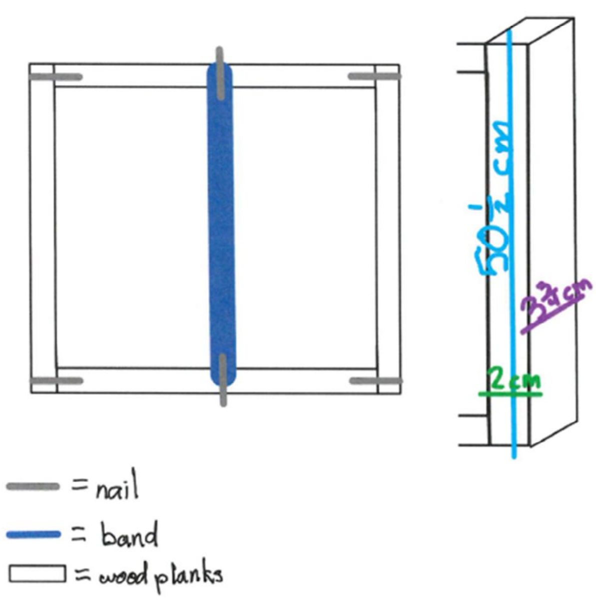
1 Use 2 wood planks to make a L
2 At the corner, take a screw and hammer the nail in
3 Repeat steps 1-3 again
4 With the 2 L's, connect to make a square
5 Nail in the screws on the top and bottom
6 Check if the screws are tight (if not, go to the next step; skip if tight)
7 Continue to hammer in nails until the nails are tight
8 Continue building the slingshot

9 Nail the top of the frame to attach rubber band

10 Repeat step but on the bottom (Not the bottom of the frame)



11 Cut a piece of leather and tape on the middle of the rubber band
12 Place rolled up newspaper, put on leather, pull back and release



DATA COLLECTION/MATH CONCEPTS TABLE

PART 3: CONSTRUCTION + DATA COLLECTION

Type of machine constructed ~

Projectile B

Task to complete ~

Launching a newspaper B

Data Collection ~

TRAJECTORY LAB DATA TABLES

**** Complete the below with the whole class ****

Horizontal Time:

Trial	Time for dart to travel 6m horizontally (seconds)
1	N/A
2	
3	
Average (t_H)	

Horizontal Velocity (V_H): ______________ m/sec

**** Complete the below in your group ****

Distance Dart will be dropped from: 1 m

Vertical Time:

Trial	Time for dart to fall from firer's hand to ground (seconds)
1	.69
2	.63
3	.66
Average (t_V)	.66

Horizontal Distance your dart should travel (D_H): 0.5 m

!!!!! This is the distance away from your firer you should place your target!

Firing Data:

Trial	Accuracy? (yes/no)	Time dart was in the air (sec)
1	No	0.58
2		0.52
3		0.49
4		0.53
5		0.54
Average		0.53

Modifications ~

- Broke so we tried to duct tape/tie it together.
- Tried adding an elastic
- Tried changing the newspaper

B

PRESENTATION