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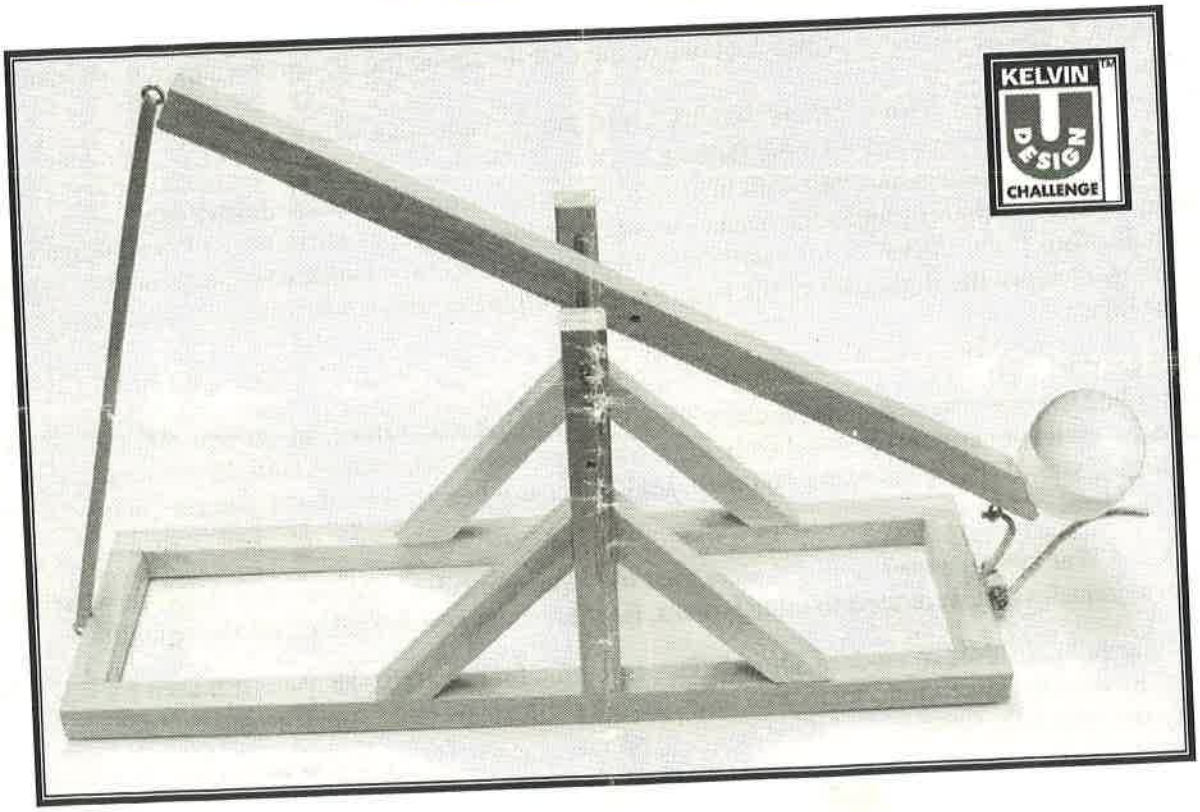
Mini-Catapult

Part Number 841362/841815 Form Number 651795



Contents:

Wood Strips
Screw Eyes
Rubber Bands
Metal Rods
Ping Pong Balls
Air Line Tubing
Grid Sheet
Wire
Mechanical screw& nut
Instructions

Tools / Supplies Suggested:

Brads
Cardboard (gussets)
Miter Box
Saw
Wood Glue & Hot Glue
Hammer
Drill
Pencil and Ruler

The written materials used in this Kelvin Educational Kit are recommendations for the teacher. Teachers are encouraged to make modifications to this activity to fit their particular needs and learning situations. As with any project the teacher should assemble a sample before engaging students in the activity.

Safety First
This kit should be assembled with adult supervision. Be careful and avoid injury when working with tools or when using the catapult.

Disclaimer – This product requires the use of tools that could be dangerous and might cause an injury if not handled with care. This kit is not to be used by young children. Use the kit at your own risk.

Objectives – In utilizing this kit students will:

- Work with tools to process materials and assemble a product
- Incorporate engineering design techniques
- Explore an historical aspect of technology

Design Challenge - Teachers can select one or more of the following design challenges or develop their own.
The student will plan, build, test and modify a miniature catapult that will:

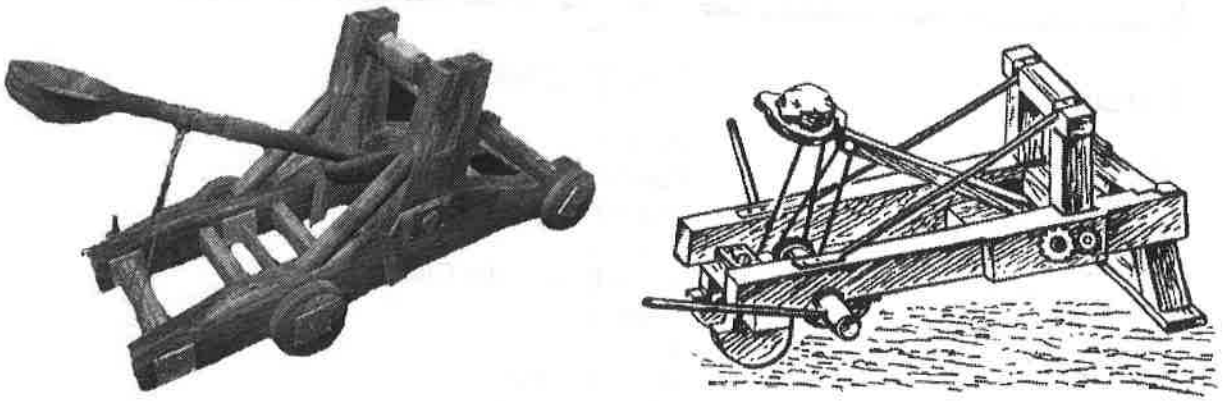
- Launch a table tennis ball the farthest
- Launch a table tennis ball with the greatest accuracy from two different distances

In conjunction with this project the teacher should schedule lessons, experiments and/or activities dealing with the history and early uses for catapults, contemporary uses for catapults, levers, structures, constraints and how to adjust the flight path of the ball. Students might perform a web search to investigate some of these topics.

Background
According to some researchers catapults were invented in Syracus, Greece in the year 400 B.C. Over the years catapults of various types and names (gastraphetes, trebuchet, onager, ballista, etc) were developed as engines of war. When gunpowder and more sophisticated weapons were developed catapults were used less and less.

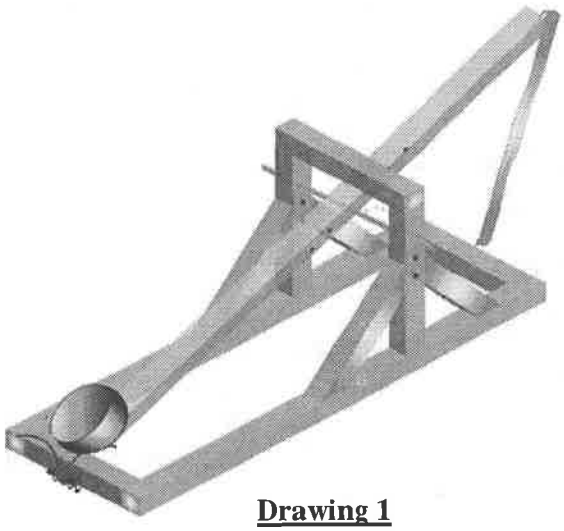
In World War I small trees (saplings) were used to launch grenades. Soldiers used the same principles to launch grenades that were used to launch rocks, fire, debris and even dead bodies in earlier times.

How are catapults used in modern Times? This is a topic for research. They are still used for war. How? They are used for recreation. In an area of Delaware participants build sophisticated catapults for a pumpkin launching contest!



Ancient catapult type devices

Mini-Catapult Design Challenge



Drawing 1

The teacher may want to change or modify some of the conditions set forth in this design challenge to better satisfy their needs.

Challenge

To design, build and test a catapult that will launch and land a table tennis ball into a container or a miniature castle from two different distances. The near distance will be eight feet and the far distance will be sixteen feet. You will take ten shots from each distance and record your percentage of "hits".

Material

Use only the materials supplied in the kit and/or those allowed by the teacher.

Constraints

The catapult must:

- Be able to fit in a shoebox with the lid closed
- Have a locking mechanism
- Be shot by releasing the locking mechanism
- Be adjustable (in order to shoot different distances)
- Be completed by _____

Suggestions

Make the catapult strong, as it will undergo varying amounts of stress during testing and use. Allow ample time for testing and modifying the catapult, do not spend all your time building.

Assessment Suggestions

The teacher may want to assess the following aspects of this project

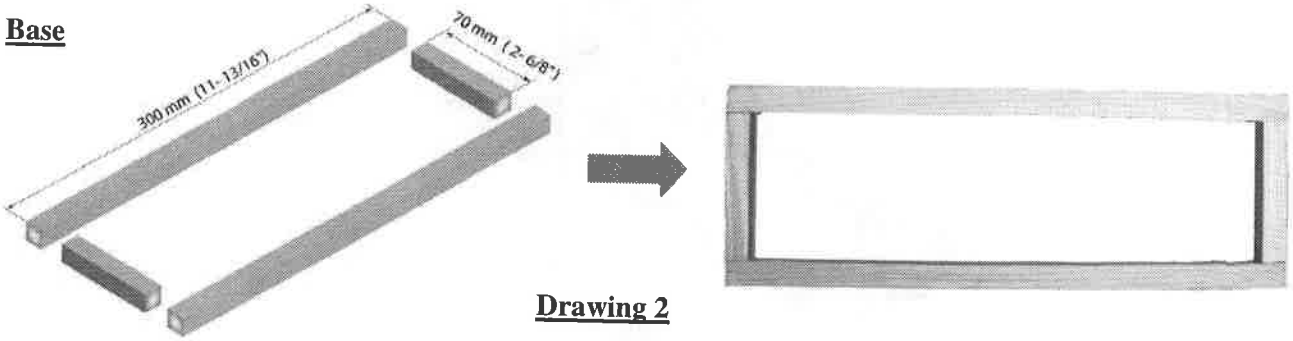
1. Quality of construction
2. Planning
3. Design Portfolio
4. Performance or efficiency of the catapult
5. Oral Presentation

The teacher can choose one or all of the criteria listed above for assessment. Items 1,2,3, and 5 could be assessed using a teacher-designed rubric. Items 2 and 3 could be incorporated into one document. Performance could be the percentage of hits made out of ten attempts from each distance. Six hits out of ten tries would be 60%. The scores from both distances could be averaged together to make a single performance grade.

It is suggested that as many different things be evaluated as possible and that the students be kept aware of their progress as they develop the catapults.
Students should submit their plans, design portfolio and finished catapult for grading. They should make a short oral presentation showing their catapult and explain why they chose their design. How they fulfilled the requirements. Why they were or were not successful and what they would do differently if given the opportunity.

Parts design suggestion and assembling

Base



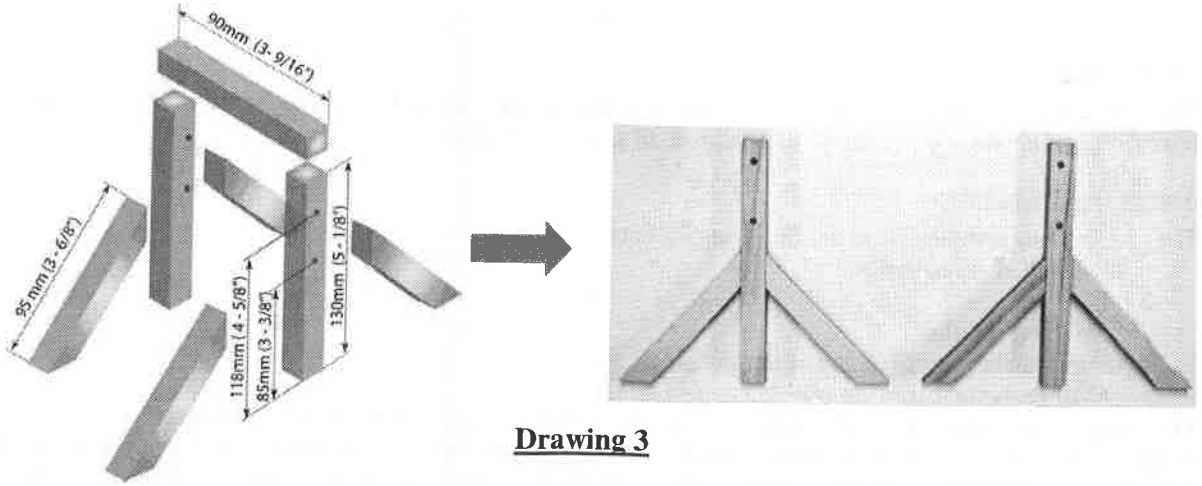
Drawing 2

Following Drawing 2, cut and assemble the base.

1. The length of the base is 300 mm (11-13/16") and the width is 95 mm (3-6/8").
2. Use the attached grid paper and design the base of the Catapult.
3. Cut from the enclosed wood two pieces of 300 mm (11-13/16") each.
4. Cut two pieces 70 mm (2-6/8") each.
5. Assemble the base as shown in **Drawing 2** and glue.

Truss Supports

Following Drawing 3, cut assemble and drill the Truss Supports.



Drawing 3

1. The height of the truss supports are 130 mm (5-1/8").

2. Use the attached grid paper and design the Truss supports of the Catapult.

3. Cut from the enclosed wood two pieces of 130 mm (5-1/8") each.

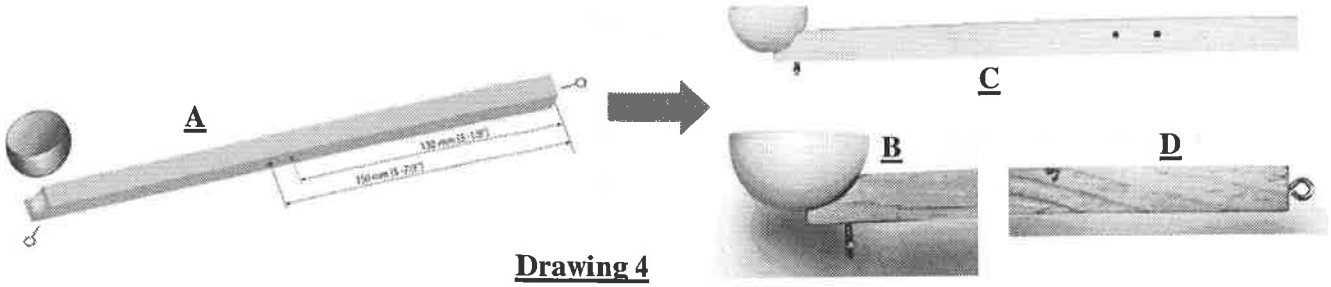
4. Cut four pieces 95 mm (3-6/8") each, for the 45° Beams.

5. Assemble cut parts as shown in **Drawing 3** and glue.

6. Drill the holes for the shaft of the lever Arm with 3 mm drill.

Lever Arm

Following Drawing 4, cut assemble and drill the Lever Arm.



Drawing 4

1. The length of the Lever Arm is 300 mm (11 – 13/16").

2. Use the attached grid paper and design the Lever Arm of the Catapult and halls location.

3. Cut from the enclosed wood one piece of 300 mm (11 – 13/16").

4. Cut in half one of the ping pong balls and attach to end of wood to act as a basket. As shown in **Drawing 4B**.

5. Sand the edge of the arm to create better attachment with the basket, **Drawing 4C** and glue.

6. Drill the holes for the shaft with 3 mm (1/8") diameter drill.

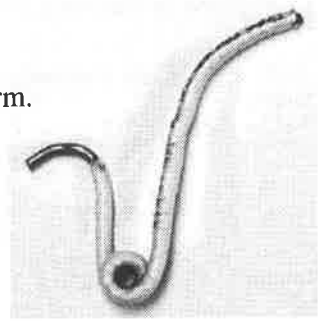
7. Following **Drawing 4B** and **4D**, screw the eye hooks in place.

Trigger Assembly

Following Drawing 5, Bend the Catapult Trigger.

1. Following **Drawing 5**, bend the attached copper wire to the desirable form. Use the enclosed mechanical screw to create the loop.

2. Strip 12mm (1/2") of the insulation around the copper wire.

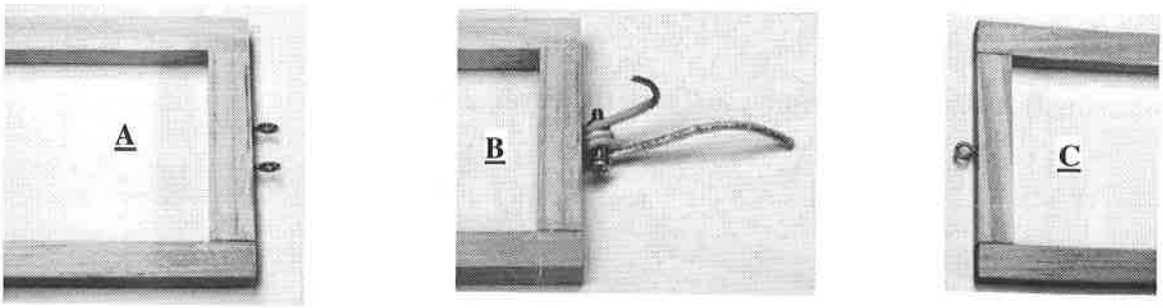


Drawing 5

3. Follow **Drawing 6A** and screw two of the attached eye hooks into the base. Make sure this is the center of the base.

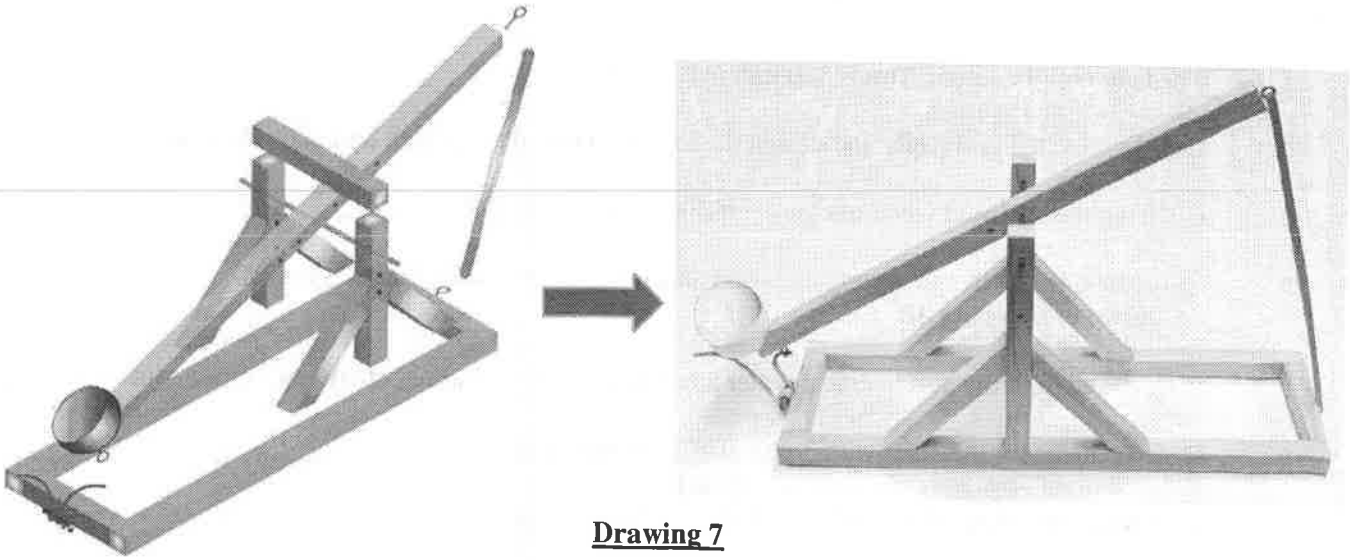
4. Following **Drawing 6 B**, Insert the mechanical screw into the first eye hook, then insert the trigger onto the screw. Push the screw to the end troughs the second eye hook, close the screw with the attached nut.

5. Following **Drawing 6C**, screw an eye hook on the other side of the base, for the rubber band.



Drawing 6

Assembling the Catapult



Drawing 7

Following Drawing 7 complete all final steps to assemble the catapult.

2. Make sure before gluing the Truss Supports to fit the trigger into the Lever Arm when it's **tense**.

3. Use the enclosed tennis ball for launching your catapult.

4. Try different location (heights) of the Lever Arm to absorb changes.

ENJOY