

The Effect of the Number of Bands on a Catapult

Problem / Testable Question

How further can a catapult throw a payload depending on the number of rubber bands?

Background Information

A catapult uses the elastic energy to throw a payload. This elastic energy comes from rubber bands which are tied with the frame and the bucket arm. More rubber bands can provide more elastic energy to the catapult. The payload can be thrown further.

Hypothesis

I think if I add more rubber bands to the catapult, it can throw the payload further because more elastic energy will be provided by the the rubber bands.

Variables

What variable was changed in your experiment?
(Independent Variable)

The number of rubber bands was changed.

What variable was measured in your experiment?
(Dependent Variable)

The distance of throw

Materials

Quantity (detailed list)	Materials (be specific)
Amount	Item
1	Catapult
4	Rubber bands
1	Payload cube
1	String ruler

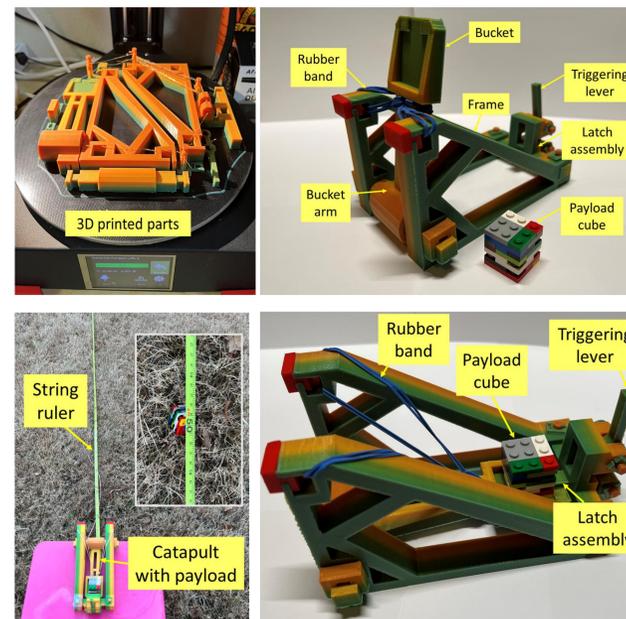
Procedure

1. Assembled 3D printed parts to build a catapult.
2. Prepared a payload made of lego bricks and four rubber bands with the same color, length, thickness.
3. Set up the string ruler to measure the distance of throw.
4. Installed one rubber band on the catapult.
5. Loaded the payload and triggered the lever to throw.
6. Measure the distance of the throw.
7. Repeated the throw five times.
8. Added one more rubberband to the catapult and repeated from the step 5 to 7.
9. Repeated the step 8 until the total of the used rubber bands is four.

Results

The catapult threw the payload 280 mm in average and 313 mm at maximum with one rubber band. Two rubber bands made the catapult to thow 556 mm in average and 629 mm at maximum. Three rubber bands achieved 728 mm in average and 800 mm at maximum. Four rubber bands did 959 mm in average and 1060 mm at maximum.

Photos



Conclusion

More rubber bands provided more elastic energy. The catapult can throw the payload further with more rubber bands. The maximum distance of throw was 1060 mm with four rubber bands. The minimum distance was 265 mm with one rubber band. This experiment proved my hypothesis. I predicted that the catapult can throw further with more rubber bands. This finding can be applied to any devices which use the elastic energy from the rubber bands. For example, rubber band-powered car or airplane.

References

Franco Normani, "Catapult Physics", REAL WORLD PHYSICS PROBLEMS, January 2, 2022, <https://www.real-world-physics-problems.com/>

Scientific Buddies, "Build a Catapult", Scientific American, January 2, 2022, <https://www.scientificamerican.com/>

Building a Catapult, Science Max, June 24, 2018, <https://youtu.be/5P5hzargP-U>

Source: "Elementary Citation Guidelines." Freedom Trail Elementary School. September 10, 2017. www.averyschools.net.

Chart

The # of the bands	The Distance of Throw (mm)					
	1st Trial	2nd trial	3rd trial	4th trial	5th trial	Average
1 Band	313	275	265	277	273	280.6
2 Bands	541	620	554	560	509	556.8
3 Bands	800	704	722	692	726	728.8
4 Bands	1060	945	1000	939	855	959.8

Graph

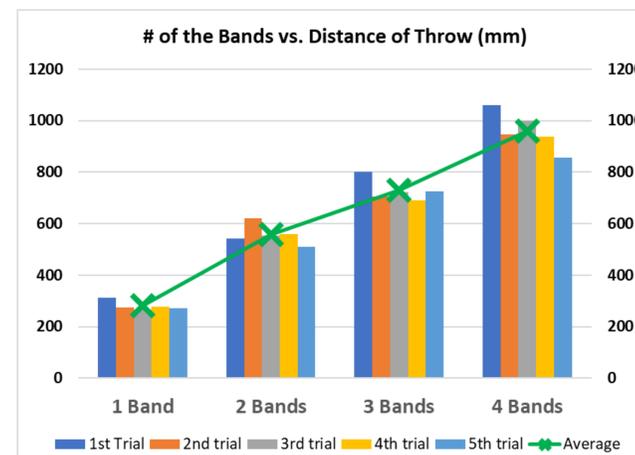


Photo and Display Credits

All photos, images, and graphics were done by the researcher or parent unless otherwise stated.

Reflections on Learning



Please answer the following questions about your project.

1. Where did you do your project and who supervised you?

ANSWER: I did my project at home and my parents supervised me.

2. Please fill out the chart with the safety risks for your project and the safety measures you used.

Possible Safety Risk	Safety Measures Used
Example: Use Power Drill	Parent Supervised
Example: Handled Liquid Chemicals	Wore gloves and washed hands after use
Example: Plants Grew Mold	Threw plants away as soon as they molded

ANSWER:

Possible Safety Risk	Safety Measures Used
Print parts with a 3D printer	Parents supervised
Assemble a catapult with tools	Wore gloves and safety glasses
Add rubber bands	Wore gloves and safety glasses
Line of throw	Parents supervised

Did you follow all of the Austin Energy Regional Science Fest's Elementary Rules and Guidelines?

ANSWER: Yes

3. What gave you the idea for this project?

ANSWER: My farther gave me a catapult toy to play. I wanted to throw the payload further. I reserched how to do and my parents helped me to test my ideas.

4. What did you learn from doing your project?

ANSWER:I learned the elastic energy can be used to throw the payload. The rubbers store the enegy from my muscles and the catapult can changed the elastic energy to kinetic enegy for the trhow.

5. What would you change about the project and why?

ANSWER:I wanted to measure the flying times with a stopwatch to calculate the flying speeds depending on the number of the rubber bands. However, the flying times were too short to measure and it was hard to differentiate the speeds depending on the number of the bands.

6. What new questions do you have?

ANSWER:I got some questions during my project.

1. How can I measure the throw distance and flying time more accurate?
2. Can I measure the elastic energy of the rubber bands with the other methods?

7. Is there anything else you want to tell your judge?

ANSWER:Science is fun and practical! I want to study physics and chemicals to make cool things.