



BUILDERS BONANZA

Lesson: Catapults

CURRICULUM REFERENCE: Strong and Stable Structures, Forces Causing Movement

LESSON OBJECTIVE

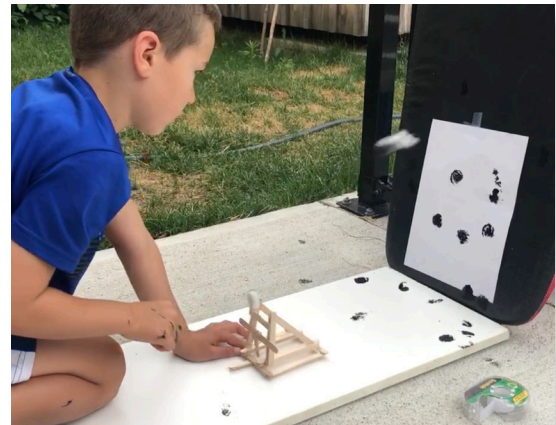
Build your own catapult to see how far a cotton ball or other small objects will fly through the air using force and energy.

VIDEO: <https://youtu.be/tVdGhVZO6Bg>

THE SCIENCE BEHIND

Catapults are a physics-based project that uses stored energy to project an object without the use of an explosive. The three primary energy forces are tension, torsion, and gravity.

VIDEO: <https://youtu.be/6U8ZS9r0kq8>



FOLLOW-UP QUESTIONS

1. How does the form of this catapult affect its function?
2. What forces are acting on this catapult to help make it and the cotton ball to move?
3. Why does the sturdiness of the structure matter?
4. What are some structures we see in our everyday lives that we depend on to be strong and stable?

LEARNING OUTCOMES

- Assess effects of strong and stable structures on society and the environment.
- Investigate, through experimentation, how various materials and construction techniques can be used to add strength to structures.
- Identify structures in the natural environment and in the built environment.
- Identify the stability of a structure as its ability to maintain balance and stay fixed in one spot.
- Describe ways in which the strength of different materials can be altered.
- Describe ways to improve a structure's strength and stability.
- Explain how strength and stability enable a structure to perform a specific function.
- Describe ways in which different forces can affect the shape, balance, or position of structures.



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MATERIALS (PER PERSON)

- 4 elastic bands
- 20 popsicle sticks
- Tape
- 10 Cotton balls
- Paint
- 1 plastic bottle cap
- 2 sheets of paper
- Hot glue

INSTRUCTIONS

- Using the first four popsicle sticks, create a square base by gluing the ends together.
- Take three more popsicle sticks and glue them into a stack, one on top of each other. Now make a second stack of three popsicle sticks.
- Take another popsicle stick and hot glue a plastic bottle cap to one end with the flat part facing the popsicle stick.
- Take the square and the stacks and glue them together to make three equal parts across the square.
- Now, take three more popsicle sticks and create a backwards “4”. Make sure the cross part of the “4” hits the middle of the vertical stick. Repeat this step to make a second identical “4” shape with three popsicle sticks.
- Cut off excess popsicle stick ends so you are only left with the main triangle.
- Attach both triangles along both sides of the stacks found on the main base square.
- Take the popsicle stick with the bottle cap and another popsicle stick and tie them together by wrapping an elastic band around them tightly.
- Using the excess popsicle stick pieces from before, cut and glue them onto the sides of the triangles for added support to your structure.
- Now let’s add the arm onto our catapult. Do this by gluing the two cross pieces (perpendicular to the bottle cap) to the back side of the base structure.
- Glue another popsicle stick across the front of the arm to stop the arm with the bottle cap.
- Take another excess piece and glue it to the bottom of the base (underneath, but flat to the structure) where we will eventually attach the elastic band.
- Take another popsicle stick and cut it into smaller pieces to reinforce the brace. This will go behind the cross piece and in front of the arm with the bottle cap.
- Now, we pull the elastic band under the structure and onto the small bottom tab.

VIDEO DEMOS:

Step 1: <https://youtu.be/jr6zWgXjFRo>

Step 2 & 3: https://youtu.be/8KNn_u9LaXy

Step 4 - 6: <https://youtu.be/r9jqZUzqvVg>

Step 7: <https://youtu.be/oXMa3PzoD6k>

Step 8 & 9: <https://youtu.be/bpl6WpXeQsk>

Step 10 - 12: <https://youtu.be/YW0u-vftsXM>

Step 13 & 14: <https://youtu.be/x5gQd5V3Dcc>