GRADE 5

EXPLORE

BUILDERS BONANZA

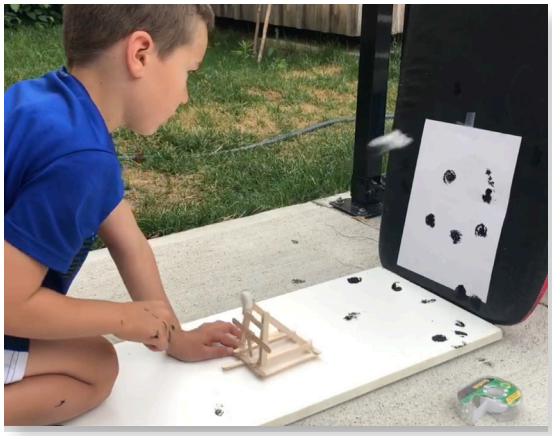
Lesson: Catapults

CURRICULUM REFERENCE: Forces Acting on Structures and Mechanisms

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. Why are the forces that are acting upon the catapult critical to its success to move the cotton ball?
2. Based on the use of forces, how can we change the distance the cotton ball travels?
3. What happens to the cotton ball when the catapult itself is bigger? What if we used an object heavier than a cotton ball?

LEARNING OUTCOMES

- Analyze the effects of forces from natural phenomena on the natural and built environment.
- Measure and compare, quantitatively and/or qualitatively, the force required to move a load using different mechanical systems and describe the relationship between the force required and the distance over which the force moves.
- Explain the advantages and disadvantages of different types of mechanical systems.
- Describe how protective sports equipment protects the body from the impact of force.

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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

1. Using the first four popsicle sticks, create a square base by gluing the ends together.
2. 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.
3. Take another popsicle stick and hot glue a plastic bottle cap to one end with the flat part facing the popsicle stick.
4. Take the square and the stacks and glue them together to make three equal parts across the square.
5. 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.
6. Cut off excess popsicle stick ends so you are only left with the main triangle.
7. Attach both triangles along both sides of the stacks found on the main base square.
8. Take the popsicle stick with the bottle cap and another popsicle stick and tie them together by wrapping an elastic band around them tightly.
9. Using the excess popsicle stick pieces from before, cut and glue them onto the sides of the triangles for added support to your structure.
10. 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.
11. Glue another popsicle stick across the front of the arm to stop the arm with the bottle cap.
12. 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.
13. 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.
14. 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