



Storm the Castle: Catapults

Question: How does conservation of energy allow catapults to launch payloads?

Background: A catapult is a device used to launch some sort of object large distances without the use of any propellant. Catapults are thought to have originated in the late 4th century BC in ancient China. They began being widely used in Greece around the 1st century BC. Catapults rely on the conservation of energy. Tension in the catapult stores potential energy, and when the tension is released, it is converted into kinetic energy which can be used to hurl large objects long distances.

Activity: Build a 'shoebox catapult' and determine what payload can tear through newspaper or tissue paper from at least five feet away.

Vocabulary:

- Potential Energy
- Kinetic Energy
- Tension

Materials:

- 1 small box (about the size of a shoe box)
- 1 plastic spoon
- 1-2 rubber bands
- 1 brass, two prong fastener
- Duct tape
- Empty toilet paper or paper towel roll
- Tissue or news paper
- Small household objects (no rocks, marbles or super hard things that could hurt someone) for payload. Examples could include marshmallows, uncooked macaroni noodles, dry beans, pom-poms, cotton balls

Procedure:

1. Tape the toilet paper roll on one side of the box.
2. Cut a small hole in the toilet paper roll.
3. Insert a plastic spoon into the hole. Remove the spoon, and reinforce the slit using duct tape. Replace the spoon. The indented part of the spoon (what you hold food in) should be facing in the direction you will be launching your payload.
4. Wrap a rubber band around the spoon immediately beneath the part that holds the food. Use a small piece of duct tape to secure the rubber band to the spoon.
5. Poke a small hole in the box a few inches in front of the toilet paper roll. The rubber band should have to stretch to reach the hole.
6. Push the brass two prong fastener through the hole. Fold the prongs under the box so they are flush with the cardboard and cover with a piece of duct tape.
7. Thread the rubber band around the brass fastener. The spoon should be pulled downward.
8. Choose different household items to launch from your catapult. Rocks, marbles or other objects that are dangerous at high velocities should not be used.



9. Use experimentation to observe how far your catapult can launch payload. You may experiment with different rubber bands.
10. Tape a piece of tissue or newspaper onto the opening of a tall box or a door. Your job is to shoot an object through the tissue or newspaper from at least five feet away.

SAFETY CONSIDERATIONS: Do not aim your catapult at any person or pet. Remain a safe distance away from the newspaper or tissue paper to ensure you do not get hit by your payload.

Explain:

Explain the conversion of potential and kinetic energy that allows catapults to launch their payloads.

Extensions:

Conduct research on trajectory, gravity, surface area and air resistance. Discuss how all of these variables can be used to optimize the efficiency of your catapult.

