Basketball Catapults

Grade Level: 5-8

Duration: 45-60 minutes

Classification: Classroom

Subject(s): Physics, Engineering

Categories (STEM): Engineering

Keywords: Physics, Engineering, Basketball, Catapult

Introduction

- Summary: In this challenge, students will design and build a basketball goal that must be the correct size to allow a ping pong ball to pass through the hoop and then create a device that will shoot the ball!
- Description:
    - Students are given their materials and design constraints.
    - They must construct a catapult and a hoop for their basketball to land in.
    - Students will test and redesign their catapults as they learn more about which elements of their design are successful in accomplishing projectile motion.

Online Resource: https://sciencemadefun.net/downloads/basketball_STEM.pdf

Vocabulary

- Projectile motion = the motion of an object thrown or projected into the air
- Catapult = device used to launch a projectile a great distance

Materials

Material	Quantity	Reusable?
Cardboard	1-2 pieces per 4 kids	Yes
Pipe cleaners	5 per 4 kids	Yes
Popsicle sticks	10 per 4 kids	Yes
Masking tape	4 rolls per classroom	Yes
Straws	10 per 4 kids	Yes
Rubber bands	5 per 4 kids	Yes
Dixie cups	1 per 4 kids	Yes
Scissors	1 per 4 kids	Yes
Rulers	1 per 4 kids	Yes
Nylon stockings	1 per 4 kids	Yes
Empty toilet paper rolls (optional)	1 per 4 kids	Yes

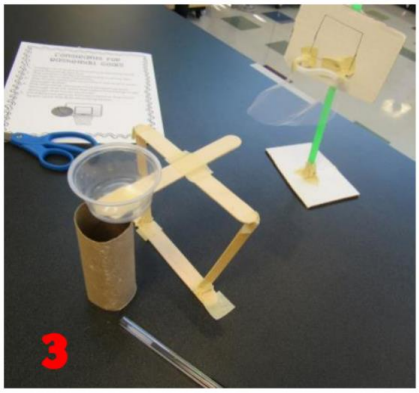
Paper (to plan design)	1 per 4 kids	No
Ping pong balls	1 per 4 kids	Yes
Pens/pencils	1 per kid	Yes
Photo examples	1 per 4 kids	Yes

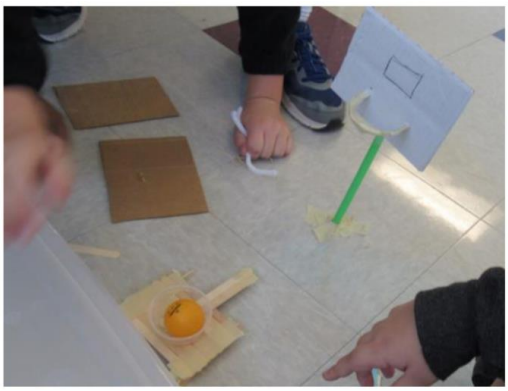
Students are allowed to cut up their materials as needed.

Directions

- In this challenge, students will design and build a basketball goal that must be the correct size to allow a ping pong ball to pass through the hoop and then create a device that will shoot the ball!
- Have the students gather in groups of 3-4 and brainstorm a team name.
- Show the students what materials they will be given to build a basketball hoop and a catapult. Tell them the following design constraints and write them on the board.
    1. **Design and build a standing basketball goal and throwing device.**
    2. **The bottom of the backboard must be 6-8 inches from the tabletop.**
    3. **The throwing device must propel the ball through the air so that it can go through the hoop and net.**
    4. **The throwing device must rest on the table top and operate as the only mechanism throwing the ball.**
- Ask the students to draw a sketch of what they plan to create.
- Give the students at least 15 minutes to build their catapult and their basketball hoop.
- Designate a time to give each group three chances to test their basketball hoop and catapult in front of the class.
- Ask each group to reflect and evaluate their design. What changes can they make to improve their catapult or hoop design? Give the students more time to make their changes.
- Ask each group to present their design to class and showcase it by shooting the ball into the hoop.
- Talk to students about the engineering design process and what challenges they faced during this activity.

Design Ideas:





Activity Extension

Increase the distance the catapult has to travel to reach the basketball hoop.

Discussion Questions

- Was your group successful? Why or why not? How many times did your basketball go through the hoop?
- What was one thing you had to modify after you tested your catapult for the first time?

What is happening?

- Catapults create projectile motion as they throw the basketball through the air. The basketball has an arched pathway because of gravity and the forward force of the catapult.

Applications:

- Majors
  - Physics
  - Engineering
- Jobs
  - Physicist, mechanical engineer, construction engineer, aerospace engineer
- Hobbies
  - Basketball, baseball, volleyball, golf, frisbee, archery, etc
- Real-World applications
  - Sports
  - Archery
  - Volcanoes project objects via eruption
  - Trebuchet