

Basketball Catapult STEM Activity

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WTS, ASCE, and MES



>Mississippi

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Build a Catapult and Basketball Hoop

DESIGN CHALLENGE

In this challenge, students will design then build a catapult and a basketball goal that must be the correct size to allow a ping pong ball to pass through the hoop.

MATERIALS

- 6 Craft sticks
- 1 Spoons
- 3 Rubber bands
- 1 Ping pong ball
- 1 Straws
- Masking tape
- 1 Pipe cleaner
- 2 pieces of Cardboard



Mississippi Coliseum Downtown Jackson

This image provided by MDAC.ms.gov

INTRODUCTION

There are several parts of a catapult system. In this activity, participants help design a catapult to shoot free throws and go through a hoop.

Ask questions to get participants thinking about the design process:

- Design and build a standing basketball goal and throwing device
- The bottom of the backboard must be 6-8 inches from the tabletop
- The hoop and net must allow the ball to pass through easily
- The throwing device must propel the ball through the air so that it can go through the hoop and net
- The throwing device must rest on the tabletop and operate as the only mechanism throwing the ball

ENGINEERING CONNECTIONS

Engineers use the design process to find solutions to problems. The design process includes defining the problem, gathering information, generating multiple solutions, analyzing and selecting a solution, and testing and implementing the solution. For today's challenge, the problem is to create a mechanism that can launch a ping pong ball into a hoop. Try to gather information (ex. the size of the ping pong ball) to inform your design, sketch your design, and test your structure.

SCIENCE CONNECTIONS

For the catapult that we will be building today, as the spoon/rubber band is bent back it stores potential energy. The potential energy is released as kinetic energy when you let the spoon go, launching the ping-pong ball. The ping-pong ball is acting as a projectile and is controlled by factors like velocity, gravity, wind, and drag. Think of it like when you are jumping. You, like the ping-pong ball, are being pulled down by gravity and being blown by the wind. Your density, and ability to overcome gravity and other factors, dictates how high you jump. The same is true of the ping-pong ball, its weight and the kinetic energy will impact how far and fast it flies.

GETTING READY

Sketch out your design for the basketball goal and color in the basketball.



Try and think about how to secure your goal to a post and have the post stand on its own.

INSTRUCTIONS

Catapult:

1. Take 5 sticks and stack them, securing one end with a rubber band. You'll need to wrap the rubber band around several times to make it nice and secure.
2. Slide one more stick between the bottom stick and the rest of the stack.
3. Secure the other end with a rubber band.
4. Place the spoon on top and attach the end of the spoon to the end of the single stick with the last rubber band.

Hoop:

1. Take one pipe cleaner and form a ring that will form the hoop.
2. Attach the pipe cleaner hoop with tape to the cardboard to make the backboard.
3. Take a straw and attach it with tape to the back of the backboard to form the post of the basketball hoop.
4. Take the remaining cardboard square and attach the bottom of the straw to the square with tape. The straw should be secure enough to stand up unaided and support the backboard/hoop.

Launch:

1. Using the catapult, place the ping pong ball in the spoon.
2. Setting the hoop on a table five feet from the catapult, try launching the ball at the hoop.
3. Adjust the design until you can sink three shots in a row.

Observe...

Where can you place the catapult to sink the ball in the hoop with the least amount of effort? Knowing that the harder you push the spoon the farther the ball will fly, how does varying the pressure impact the launch? Try it.

Learn...

Did you know that as the basketball, or in this case ping pong ball, is shot there are four forces acting on the ball? Gravity is pulling the ball down, buoyant force pushes the ball up, drag force acts on the ball due to air, and magnus force which acts on the ball as it spins. Use your test runs to ensure you are launching the ball enough to overcome these forces.



To learn more and see the video of this activity visit:

<https://www.wtsmississippi.com/stemresources>