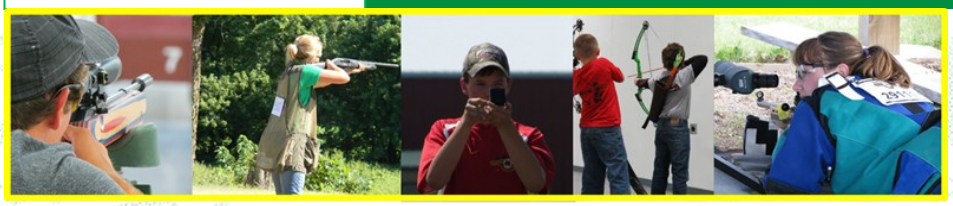

NATIONAL SHOOTING SPORTS LEARN BY DOING

Discipline: All
Age Level: All
Time: 45-90 minutes

Next Generation Science Standard : MS-PS2 – Motion and Stability: Forces and Interaction

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Marshmallow Catapults

Objective: 4-H Youth use a simple self-built catapult to illustrate the laws of force and motion.

Materials Needed:

Paper Plates
Plastic Spoons
Tape (or hot glue gun)
Rubber bands
Marshmallows
Lego Tetrix, NXT or Mindstorms (or 1 kit/3-5 youth)

Key Terms:

Lever - A simple machine consisting of a rigid bar pivoted on a fixed point and used to transmit force.

Base - The bottom or supporting part of anything.

Pivot - A short rod or shaft on which a related part rotates or swings.

Leverage - The mechanical advantage gained by employing a lever.

Kinetic Energy – Energy that an object possesses by virtue of being in motion.

Potential Energy – Stored energy that an object possesses due to its relationship to others, stresses within, electric charge, or other factors.

Directions: Read through all introductory materials first!

STEP 1
Introduce the key terms, history and design (see Page 2) and design the catapults.

STEP 2
Have each person or team explain their design, and demonstrate its ability by launching several marshmallows. Measure the distance of each marshmallow thrown. As they appear, highlight the different construction techniques used. Encourage the students to make note of adjustments they would like to make on their catapult.

STEP 3
Lead a discussion about which designs work best and why, encouraging the youth to put forward their ideas and theories. Allow the kids to reengineer their catapult, time permitting, and "launch" again.

STEP 4
Eat the remaining marshmallows.

I pledge my... Head Heart Hands Health ...To Make the Best Better.

Conducting the Lesson:
In a traditional setting, aided with chart paper or dry erase board if possible, talk about the key terms and how they are used in the construction of a Catapult. Discuss the Kinetic vs. Potential Energy. Show how a rubber band and lever both have potential energy. Illustrate that the marshmallow has kinetic energy once released. Have a brief discussion about teamwork, and what it means to be a team member. e.g. lead by example, collaborate.

Divide into teams and while working together design and build a Catapult meant to throw a marshmallow as far as possible. Give a specific time limit (45 minutes) for the build-up, and announce the remaining time frequently to ensure that the teams finish on time. (Teams may need some design help or ideas, especially if they are not used to building with the Tetrix kits).
At the end of the building time, bring the groups together and display the Catapult designs. Discuss the similarities and differences. You may ask the kids to vote on which catapult is likely to throw the farthest (usually everyone votes for their own catapult).

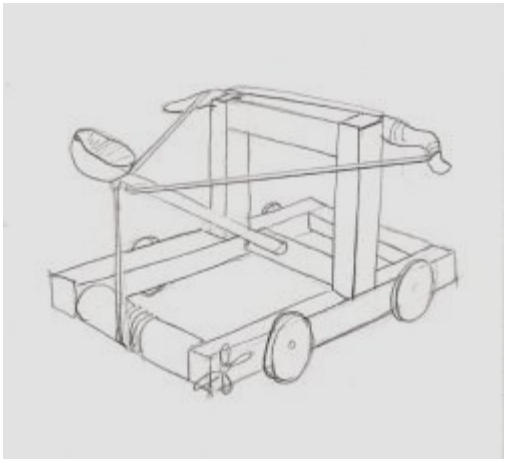
Commence the throw-off, with each team having two or three attempts to throw. Be aware that most of the catapults will self-destruct during the attempt, and will need time to rebuild between throws. Rotating from team to team will allow for the extra time to rebuild. Marking the marshmallows with a Sharpie, and leaving them on "range" where they land, and giving the team a new marshmallow for each attempt will provide a mark to determine improvement on each throw.

Conclusion:
At the end of the "competition", a few minutes to review teamwork will reinforce the behavior. Questions like, "How did you create the original design of your catapult?", How did you change the design to make it better?" Additional Questions like, "How did your team function? Was there a definite leader? Did your team consider everyone's input?" will yield great discussion and provide the ability to reinforce the attributes associated with "good" teamwork. Usually examples of "good" teamwork can be pointed out in the winning catapult team for further reinforcement.

***Additional Activities:** The lesson is easily changed from Force and Motion to Trajectory by moistening the marshmallows which will allow them to stick to a horizontal target placed in front of the catapult. The target can be moved farther away from the catapult on subsequent launches to illustrate the effects of gravity on trajectory.

***Additional Resources: https://education.lego.com/**
http://www.stormthecastle.com/catapult/the-history-of-the-catapult.htm

Background Information:
Simple catapults can be constructed using tape, paper plates, spoons and rubber band or using Lego NXT or Mindstorms kits if available. These catapults can be used to illustrate Potential and Kinetic Energy and Newton's Laws of Motion.



For more information on catapults, and a pattern for a cardboard catapult, or a popsicle stick version, visit: http://www.stormthecastle.com/catapult/the-history-of-the-catapult.htm.