

**Teacher:** Katie Offerman

**Date:** 11/1/18

**Subject/ Grade Level:** Catapults/ Second Grade

**Materials:** hot glue gun

hot glue sticks

large popsicle sticks

spoons

bottle caps

rubber bands

candy pumpkins

recycle materials (tissue boxes, bottles, cardboard, etc)

string

**Lesson Objectives:** Students will be able to create an engineered model of a catapult that throws an object the farthest distance, analyze data from tests, determine if the model works as intended, and compare the strengths and weaknesses of how different catapults perform.

**Notes:** These lessons are intended to be used after students already have knowledge of force and motion. They must apply their previous knowledge of force and motion in order to create and answer questions about catapults.

**NGSS Standards:**

K-2-ETS1-3 Engineering Design- Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

K-PS2-2 Force and Motion Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or pull.

**Engagement:** 1 day: After showing the video, linked below, engage students in a conversation about why catapults were necessary in the medieval time era. Encourage students to come up with questions like:

How does the catapult project objects through the air that are too heavy for someone to throw themselves?

Where does the force come from?

What different designs could throw the object further?

Why types of energy are being utilized?

What questions do you have about catapults?

What connections did you make while watching the video?

What do you already know about catapults?

[https://youtu.be/fInj\\_OKy1xo](https://youtu.be/fInj_OKy1xo)

**Exploration:**

**Part 1-** 2 to 3 days: Using the attached Hyperdoc, have students explore catapults. They should keep notes about what they have learned on a note catcher. I like to use a Tree Map from Thinking Maps.

<https://docs.google.com/document/d/18-emNQOCVFwyJ9AliK-t2pH15epC3ALorUa8Oxg8dXo/edit?usp=sharing>

**Part 2-** 1 to 2 days: Students use the linked google doc to plan, create, test, record data, and answer questions about their catapult trials.

<https://docs.google.com/document/d/1MRhBynM8kUWNnadHAp2EFI0-qyzCbEE-ShUKj7LeM4k/edit?usp=sharing>

**Explanation-** 1 to 2 days: **After groups have created, tested, and recorded their data. Ask groups the following questions and keep track of their knowledge as formative assessment.**

Where did the energy come from to launch your pumpkin?

What did you use as the fulcrum?

How could you increase the potential energy your catapult stores when being pulled back?

How did you calculate your average?

Explain your graph

What types of materials would cause your pumpkin to travel less distance? Why?

Have students come up with definitions for kinetic energy vs potential energy.

**Elaboration-** 1 to 2 days: As a whole class, analyze the data and look at each catapult. Create a list of catapults in order from most effective to least effective. Have students analyze the materials and designs of each catapult. They should explain what functions and materials allowed the pumpkins to fly the farthest. Then groups should decide if there are changes they would like to make to their catapult to launch the pumpkins further. If you have time, allow the teams to redesign their catapults with the changes they came up with.

**Evaluation-** 1 day: Students write an explanation for why their catapult functioned the way it did initially and how it functions with the changes (if you do not have time for them to actually make changes to their catapults, just have them use evidence to support why they think the changes will increase the distance their catapults throw the pumpkins). How did the potential and kinetic energy change when you made changes to the catapult?