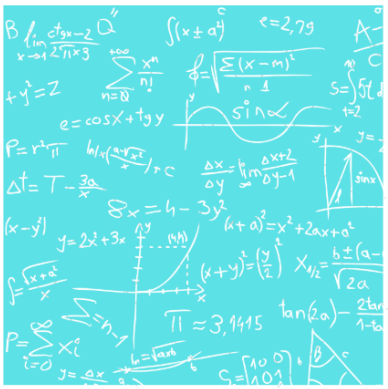
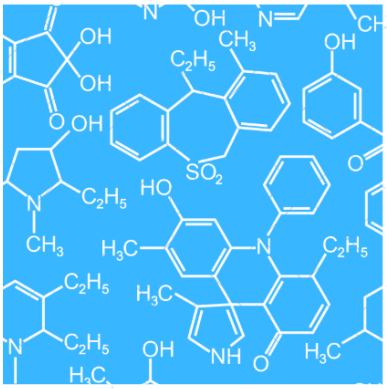


# STEM at Stead



SCIENCE WORTH EXPLORING

Written by Aubree Larson

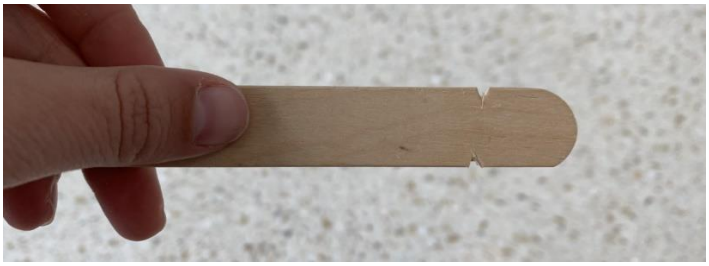
# Catapult Teacher Information: Beginner Scientist

**How do I prepare?**

1. Double check that all the necessary supplies are inside of the kit:

   - Measuring tape
   -10 Rubber Bands
   -10 Jumbo Popsicle Sticks → 8 regular, 2 notched
   - 1 Bottle Cap
   -1 Sticky Dot
   - 10 pom poms
   -10 pencil erasers

2. Refer to the picture below to see where the notches should be cut.



**What will they learn?**

1. The discussion materials for this experiment will be based off the Iowa Core Standards for third graders. The student does not have to be a third grader to complete this activity, they just need to be able to understand at a third-grade level. The standards covered by this experiment are:
   a. Physical Science → Motion and Stability: Forces and Interactions
      3-PS2-2: Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.
      *Observations will be made in part E and predictions will be made in part D
   b. Engineering, Technology, and Applications of Science → Engineering Design
      3-5-ETS1-3: Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
      *Fair tests will be carried out in part C and failure points/ improvements will be identified in part G

**Need extra help?**

If you aren't familiar with topics covered or if the student needs extra help, consider these resources:

www.billnye.com/the-science-guy/energy
www.billnye.com/the-science-guy/gravity
www.billnye.com/the-science-guy/simple-machines
www.billnye.com/the-science-guy/motion

Setting up the catapult → https://littlebinsforlittlehands.com/popsicle-stick-catapult-kids-stem-activity/

# Catapult Instructions: Beginner Scientist

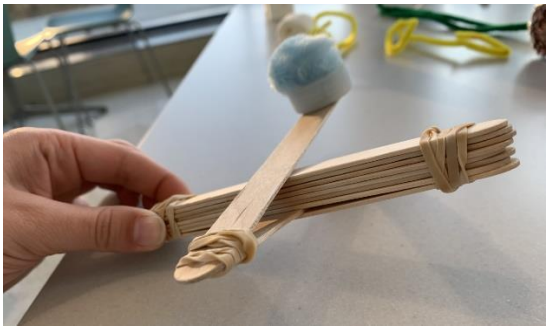
**What is the experiment?**

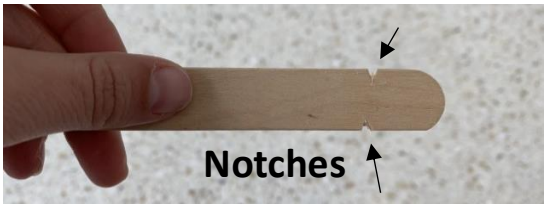
In this experiment you will be building and testing a catapult. The catapult will be made out of popsicle sticks and rubber bands. You will use a soda pop bottle cap as a bucket and place your projectile in there. Your projectile is what you will be testing! You want to use the right projectile so that your catapult launches it the farthest distance. You will be using small pom poms and pencil erasers as projectile. When you get to your trials, you can use any number of combinations of these materials.

**Predict what you think will happen in this experiment. For example, which of the projectile (pom poms or pencil erasers) will travel farther? How far do you think they will go?**

**Draw a picture of what you think will happen when you launch your catapult!**

# Catapult Instructions: Beginner Scientist






**Materials Needed:**

10 Jumbo Popsicle Sticks → 2 regular & 2 with notches in the side
Bottle Cap — Sticky Dots
Projectiles — Rubber Bands

**Instructions:**

1. If all 10 popsicle sticks are regular, you need to cut notches in two of them. They should look like the third picture from the top.
2. Take 8 of the regular popsicle sticks and stack them on top of one another. Secure the stack together with two rubber bands. Look at the second picture form the top to see what your stack should look like.
3. Slide one of the jumbo sticks with notches through the stack between the bottom two sticks. You should be able to see this in the second picture from the top.
4. Take the remaining jumbo stick with notches and secure it with a rubber band to the other jumbo stick with pieces cut out within the stack. Look over to the left at the bottom picture for some help! (the sticks held together with the red rubber band) The rubber band holding these two sticks together should rest within the hole from the missing pieces in the two sticks.
5. Place a sticky dot on the angled stick outside of the stack. Put the sticky dot on the opposite end from the rubber band about 0.5 inches from the end of the stick.
6. Place the bottle cap on the sticky dot to create a small bucket. Make sure to take the ring off the open part of the bottle cap. This is where your projectiles will be placed!
7. Use different combinations of projectile and test the distance each combination travels for five trials. Record the results in part A on the next page. Make sure you measure from the same starting spot for each trial. Also make sure to push the catapult arm down with the same force each trial.
8. Now that your trials are complete, fill out part B and C on the next page.
9. Read through the information on the second page to learn about the science behind catapults!
10. Answer parts D and E of the discussion materials.
11. Finally, turn in your finished discussion materials to your teacher and clean up your experiment area.

# Catapult Discussion Materials: Beginner Scientist

**A. Document the results of your trials below:**

Where there are blanks, fill in the number of each pom pom and pencil eraser you used for that specific trial. For the blank after the distance traveled, record how far your farthest piece of projectile (if you have multiple objects in your bucket) traveled in inches.

*Example Trial* Projectile: Pom Poms __0__ Pencil Erasers __2__ Distance Traveled ___6 in___

*Trial 1* Projectile: Pom Poms _____ Pencil Erasers _____ Distance Traveled _____

*Trial 2* Projectile: Pom Poms _____ Pencil Erasers _____ Distance Traveled _____

*Trial 3* Projectile: Pom Poms _____ Pencil Erasers _____ Distance Traveled _____

*Trial 4* Projectile: Pom Poms _____ Pencil Erasers _____ Distance Traveled _____

*Trial 5* Projectile: Pom Poms _____ Pencil Erasers _____ Distance Traveled _____

**B. Predict the distance of the following example trial:**

Projectile: Pom Poms __2__ Pencil Erasers __2__ Distance Traveled_____

**How did you make this prediction? Explain why you think it is true.**

**C. What observations and conclusions can you make from your five trials?**

# Catapult Discussion Materials: Beginner Scientist

**The science behind catapults**

Physics! The reason the projectile launches through the air and eventually hits the ground can be explained by physics. Sir Isaac Newton discovered the physics behind a catapult back in 1687. That's almost 300 years ago! He describes this in what he called the first law of motion:

*"An object at rest stays at rest, until a force is applied, and an object in motion stays in motion, at the same speed, until a force acts upon it"*

Okay let's break that down. An object at rest stays at rest- this means that the projectile will always sit in the bottle cap if we don't apply a force to it. Until a force is applied- the force we applied was the arm of the catapult. When we pull back the arm it stores up a lot of energy, but when we let go of the arm it changed the form of energy and applied a force to the projectile. This change in energy created a force that launched the projectile forward! But why did the projectile not stay in the air at the same speed if we didn't apply a force to it? Gravity! It's the force that keeps you and me from floating off into space. Gravity is the downward force acting on the projectile that eventually brought it back down to the ground.

**D. Do your results align with your prediction? Why do you think this is?**

**E. How would you change your catapult, or the projectile, to maximize the distance traveled? How much weight was too much weight for the catapult to handle?**