

Objective:

Students will learn about physics and engineering as they build, test, and modify their own catapult to launch asteroids at dinosaur targets.

Arkansas State Standards Addressed:

Math

AR.Math.Content.4.MD.C.5

Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement

Science

NS.1.4.13 Use simple equipment, age appropriate tools, technology, and mathematics in scientific investigations (e.g., balances, hand lenses, microscopes, rulers, thermometers, calculators, computers)

NS.1.4.8

Develop a *hypothesis* based on prior knowledge and observations

NS.1.4.11

Generate conclusions based on evidence

4-PS3-4 Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

Speaking and Listening

SL.5.1: Engage effectively in a range of *collaborative conversations/discussions*

Activity:

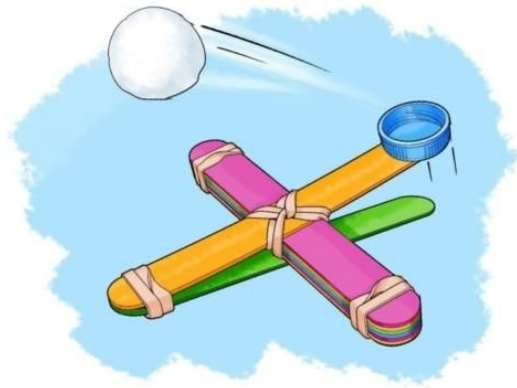
Many scientists hypothesize that a giant asteroid or comet strike caused the extinction of dinosaurs and $\frac{3}{4}$ of all animal and plant species on Earth about 65 million years ago. In this activity, students will construct their own catapults to launch projectiles at dinosaur targets. They will modify their catapult design, force, and angles of asteroid launch to successfully knock down all targets.

Instructions for constructing a catapult:

<https://www.scientificamerican.com/article/build-a-catapult/>. Teachers will also need boxes and plastic dinosaurs to set up a target display of varying heights and distances from the catapults.

Each student will need:

- Eight popsicle sticks
- Four or five strong rubber bands
- Glue
- Plastic bottle cap
- Projectile (asteroid)



Students can try to predict where the projectiles will land. Have the students test different distances and angles from the target, as well as how far the projectile flies when the catapult arm is pushed down a little versus a lot. They can record their findings.

Additional Resources at Bentonville Public Library:

The following are a selection of resources about dinosaurs, asteroids and comets, engineering, and more, which are available at Bentonville Public Library. All items are available for checkout at the Bentonville Public Library; call numbers are included in brackets. Online resources are available through BPL's Student Portal: <http://www.bentonvillelibrary.org/student-portal/>

- *Asteroid Impact* by Doug Henderson [JNF 567.9 HEN]
- *Discovering Comets and Meteors* by Isaac Asimov [JNF 523.6 ASI]
- *Dinosaurs: The Most Complete, Up-to-Date, Encyclopedia for Dinosaur Lovers of All Ages* by Thomas Holtz [JNF 92 567.9 HOL]
- *Exploring Comets, Asteroids, and Other Objects in Space* by Nancy Dickmann [JNF 523 DIC]
- *The Last Days of the Dinosaurs* by Matthew Rake [JNF 567.9 RAK]
- *Little Kids First Big Book of Space* by Catherine D. Hughes [JNF 520 HUG]
- *The Magic School Bus in the Time of Dinosaurs* by Joanna Cole [JNF 567.9 COL]
- *Mechanical Engineering and Simple Machines* by Robert Snedden [JNF 621 SNE]
- *The Mystery of the Death of the Dinosaurs* by Chris Oxlade [JNF 567.9 OXL]
- *Our Solar System* by Simon Seymour [JNF 523.2 SIM]

Online Resources

(K-4) PebbleGo

"Meteors and Asteroids." PebbleGo. www.pebblego.com. 12 January 2017.

"Let's Investigate." PebbleGo. www.pebblego.com. 12 January 2017.

(K-4) PowerKnowledge Earth Space Science

"Forms of Energy." *PowerKnowledge Earth & Space Science*, Rosen Publishing,

<http://www.pkearthandspace.com/article/622/forms-of-energy>. Accessed 12 January 2017.
"How the Dinosaurs Disappeared."

<http://www.pkearthandspace.com/article/670/how-the-dinosaurs-disappeared>."
PowerKnowledge Earth & Space Science, Rosen Publishing. Accessed 12 January 2017.

(5-6) The Encyclopedia of Arkansas History and Culture:

"Arkansas Sky Observatories." *The Encyclopedia of Arkansas History & Culture*. 29 Dec. 2016.
<http://www.encyclopediaofarkansas.net/encyclopedia/entry-detail.aspx?search=1&entryID=6626>

(5-6) World Book Student

Sauers, Richard A. "Catapult." *World Book Student*. World Book, 2017. Web. 12 Jan. 2017.

Learn More:

Museum of Science and Industry: Simple Machines Game:
<https://www.msichicago.org/play/simplemachines/>

NASA has created a student website that helps kids explore space-based careers and topics:
<https://www.nasa.gov/audience/forstudents/k-4/index.html>

PBS: What Killed the Dinosaurs?:
<http://www.pbs.org/wgbh/evolution/extinction/dinosaurs/asteroid.html>

Smithsonian Institution: National Air and Space Museum, *Exploring the Planets*:
<https://airandspace.si.edu/exhibitions/exploring-the-planets/online/solar-system/asteroids/appearance.cfm>

Explore Space Exhibit Information:

Explore Space: A Cosmic Journey, a traveling exhibition for libraries, is part of the STAR Library Education Network (STAR_Net) led by the National Center for Interactive Learning at the Space Science Institute. Exhibit partners include the American Library Association, the Lunar and Planetary Institute, and Afterschool Alliance. Explore Space is supported through a grant from the National Science Foundation.



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