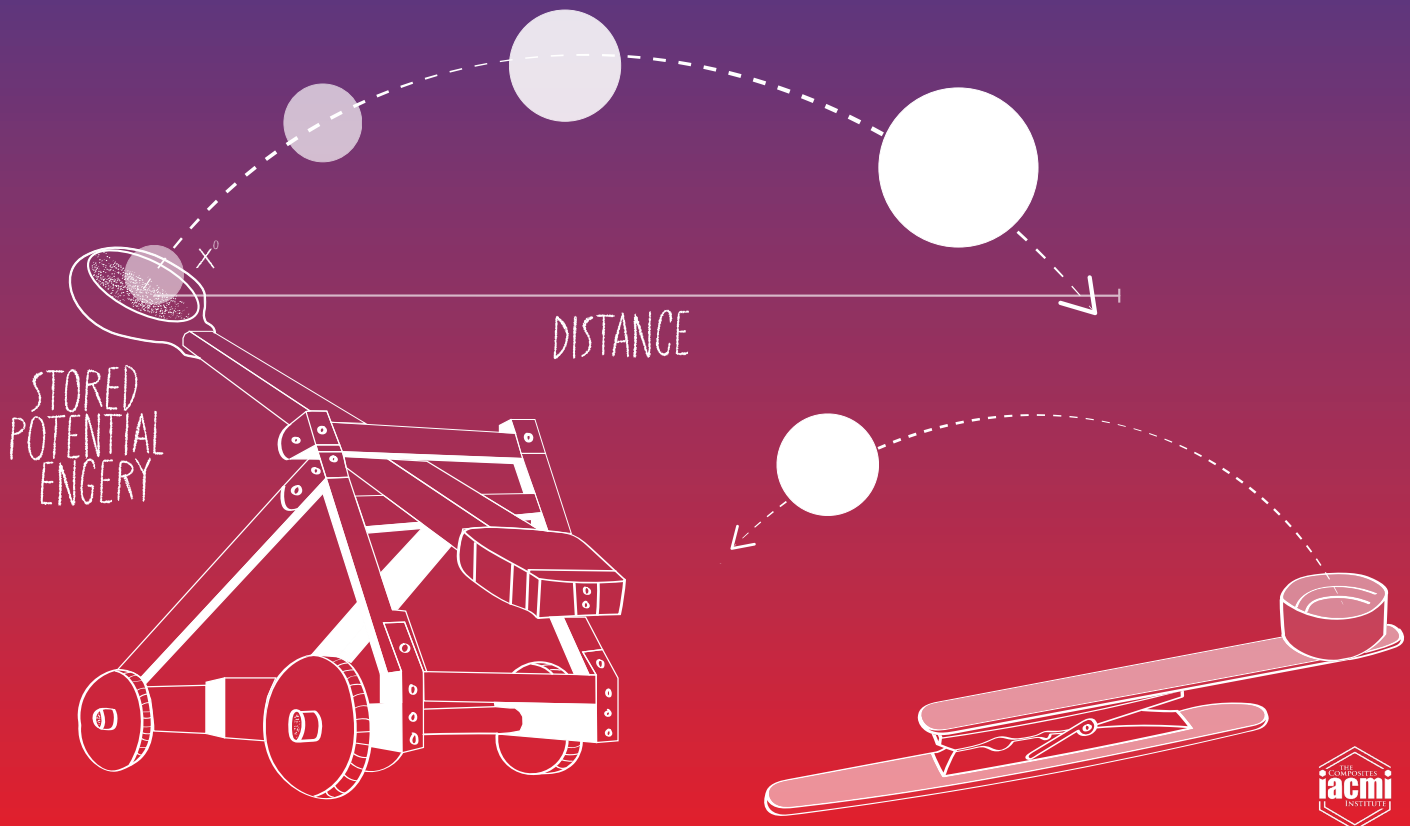
DREAM. BUILD. BECOME.

ACE METAL FOUNDATIONS

By IACMI

Catapults



Catapults

Prior Knowledge

Students should be familiar with everyday motion, such as throwing, bouncing, or dropping objects.

Students should also understand that pushing or pulling objects can make them move, and that gravity pulls things toward the ground.

Catapults

Lesson Overview

In this lesson, students design, build, and test a simple catapult to explore how **force and stored energy create motion**. Using everyday materials, students investigate how pressing or pulling on a launcher stores energy, and how releasing that energy causes an object to move.

Through repeated testing, students observe how **design decisions**—such as stability, arm movement, or applied force—affect launch performance. Students refine their designs based on these observations, building an understanding that engineers improve solutions through **testing, comparison, and intentional iteration.**

This activity emphasizes cause-and-effect relationships between force, energy, and motion while introducing students to the engineering practices of testing, evaluating performance, and improving designs.

Vocabulary

Force: A push or pull that can cause an object to move.

Stored Energy: Energy held in an object when it is bent, stretched, or pressed.

Observation: Carefully watching and noticing what happens.

Iteration: Repeating a process to make them better.

Figure 1: Medieval catapult in Castelnaud-la-Chapelle Castle in France.

Figure 2: A pulled-back slingshot showing potential energy in action.

Catapults

The Foundations of Force, Motion, and Stored Energy

Have you ever pulled back a rubber band and let it snap forward, or pressed down on something and watched it spring back? When you do this, energy is stored and then released.

When an object is bent, stretched, or pressed, it can store energy. This stored energy stays in the object until it is released. When the energy is released, it causes motion.

A catapult works using stored energy. When you press down on the catapult arm, energy builds up in the launcher. When you let go, that stored energy is transferred to the object, causing it to move through the air.

The way a catapult is built can change how this energy moves. A stable base, a strong launcher arm, or pressing down farther can affect how the catapult performs. Some designs may launch objects farther, while others may be more consistent.

By building and testing a catapult, you will observe how force, stored energy, and motion work together. When you make a change, or "iteration," to your catapult, you can observe what happens and decide how to improve it. Engineers use this process of testing, observing, and improving to make designs work better.

Materials

Materials Supplied in Kit For Option A

Per Student

- 1 craft stick
- 1 clothespin
- 1 plastic bottle cap
- 1 pom pom

Shared

- 1 hot glue gun
- 5 hot glue rods

Materials Supplied in Kit For Option B

Per Student

- 7 jumbo craft sticks
- 2 large paperclips
- 1 plastic spoon
- 2 rubber bands
- 1 pom pom

Shared

- 1 Roll of packing tape

Catapults

Activity Directions

Option A: Simple Clothespin Launcher (recommended for younger students)

Option B: Craft Stick Catapult (older students or comparison build)

Step 1: Pick a Build

Option A: Simple Clothespin Launcher

- Using hot glue, glue a clothespin to a craft stick as pictured. The closed end of the clothespin should be near the edge of the craft stick

- Using hot glue, glue a bottle cap upside-down on the end of the clothes pin opposite of the closed end

- Allow the glue to dry

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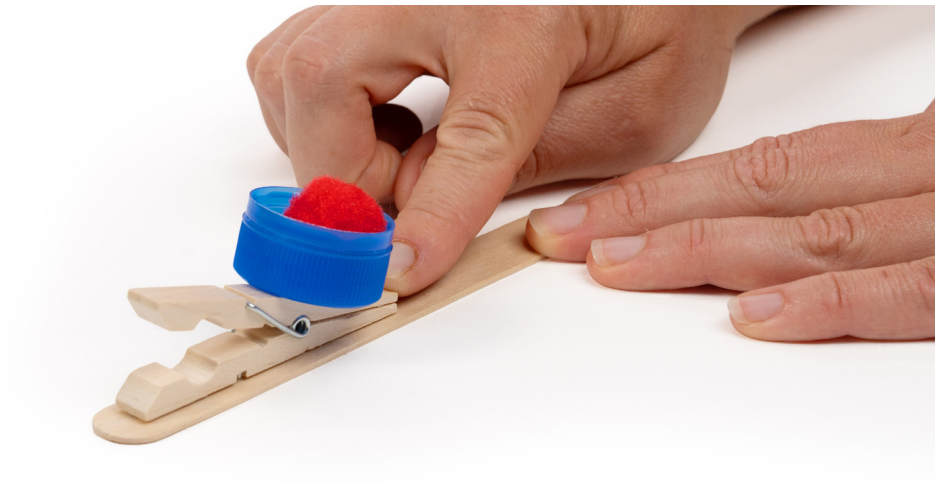
Activity Directions Continued

- Place a pom pom in the cap



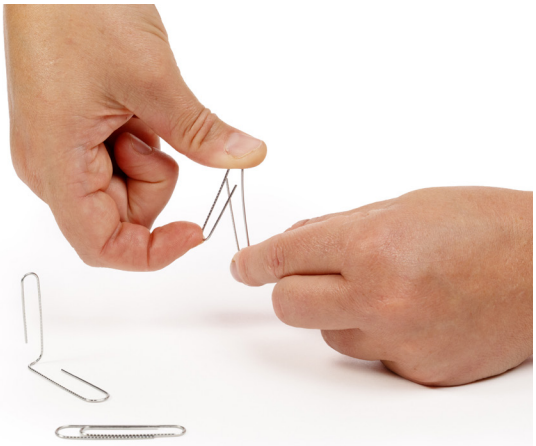
- Press down on the launcher arm and release it to launch the pom pom.

Catapults

Activity Directions Continued

Option B: Craft Stick Catapult

- Create a hinge
- Take a paperclip and lift the inner bend upwards until the paperclip forms an "L" shape



- Tape a spoon to one end of a jumbo craft stick and tape the other end of the jumbo craft stick to the raised part of the paperclip
- Tape another jumbo craft stick to the remaining part of the paperclip "L"

- Stack 5 jumbo craft sticks and wrap one rubberband around each end to secure the craft sticks to each other to form a base

Catapults

Activity Directions Continued

- Insert the free end of the launcher in between the bottom two craft sticks in the base as pictured below

- Place the pom-pom in the spoon, press down, and release to launch.

Catapults

Discussion Prompts or Reflection

- What did you do to store energy in your catapult?
- Which catapult design seemed to be able to store more energy? How could you tell?
- What part of your catapult do you think is most important? Why?
- What is one part of your catapult that you could change to make it better?

Variations and Enrichment

- Teachers may choose to build only on launcher design, or both designs to compare and contrast how structure affects motion
- Students can implement the use of measurement to compare the performance of their catapults to others
- More advanced students can use recorded data to look for patterns to determine whether or not one catapult design is objectively superior than the other

Foundation Exploration

- **Mechanical engineers** design machines with moving parts. They use stored energy to help machines push, lift, or launch objects
- **Manufacturing engineers** build and test machines used in factories. They test how parts move and improve designs before machines are made
- **Toy designers** create toys that launch, roll, or move. They test how stored energy can make toys move safely and consistently
- **Spear fishers** use tools with stretched bands that store energy. When the bands are released, the stored energy moves the spear forward, like how energy launches an object from a catapult