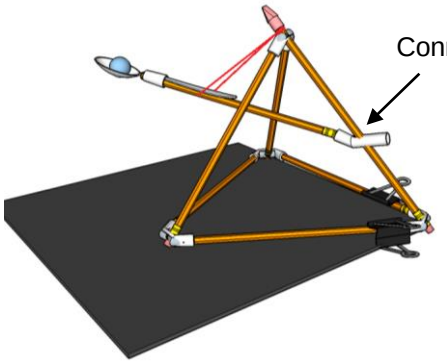
raft®
RESOURCE AREA FOR TEACHING

# CONNECT-A-PULT

Unique connector + pencils = adjustable launcher!



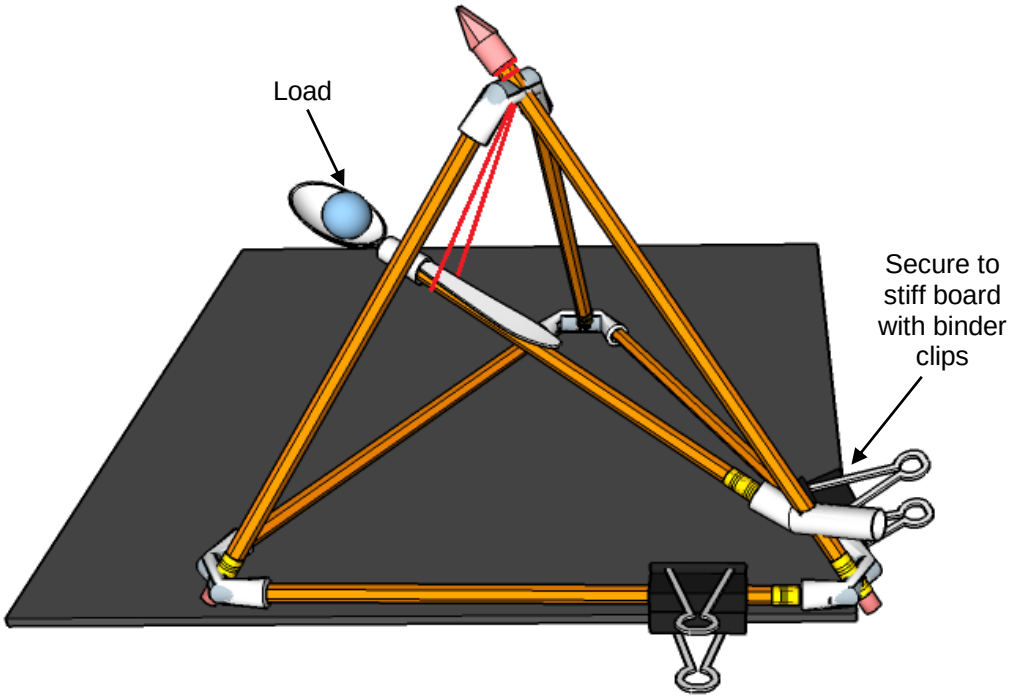

**Curriculum topics:**

- Motion and Forces
- Potential and Kinetic Energy
- Trajectories

**Subject:**
Physical Science
Engineering

**Grade range:** 2 – 12

Many catapult designs have evolved over the centuries. This design leverages common items and a little creative engineering for exploring the effects of using different launch angles and forces to send objects flying into the air! This activity is ideal for young learners as well as older students.




**Who we are:**

**Resource Area for Teaching (RAFT) helps educators transform the learning experience by inspiring joy through hands-on learning.**

**For more ideas visit**
**https://raft.net**

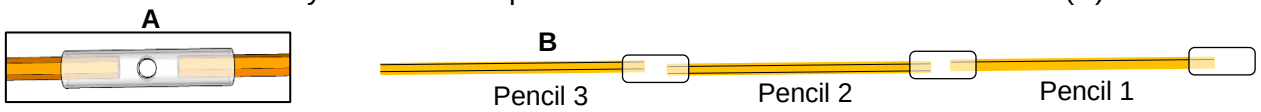
**Safe Use of the Connect-A-Pult** The Connect-A-Pult is not a toy and is intended for use under adult supervision. Always aim the catapult in a safe direction. Never aim the catapult toward eyes or another person.

# Materials required per device

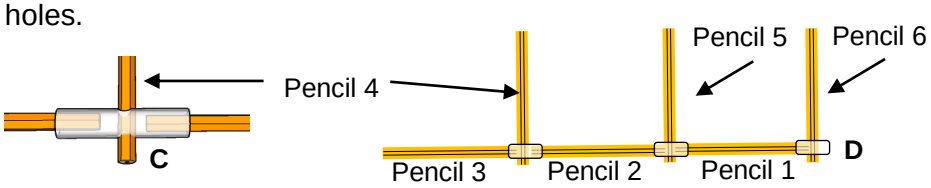
- Pencils (unsharpened) or equal (x7)
- Silicone connectors w/ center punched holes, 1 ¾” long (x5)
- Spoon, bendable/unbreakable (x1)
- Small tubing section, no punched holes (x1)
- Rubber band, 3 ½” wide (x1)
- Pencil cap eraser (x1)
- Stiff cardboard or equivalent, 12” x 12” (x1)
- Binder clip, medium (x2)
- Small objects for the load (foil, cotton balls, or similar items are ideal) (not included)

# Set-Up

**1** Insert the ends of two pencils at least 3/8” into the end of a connector without blocking the punched hole (**A**). Add connectors onto the other ends of the 2 pencils, making sure the punched holes are all oriented the same way. Insert a third pencil into one of the available connectors (**B**).

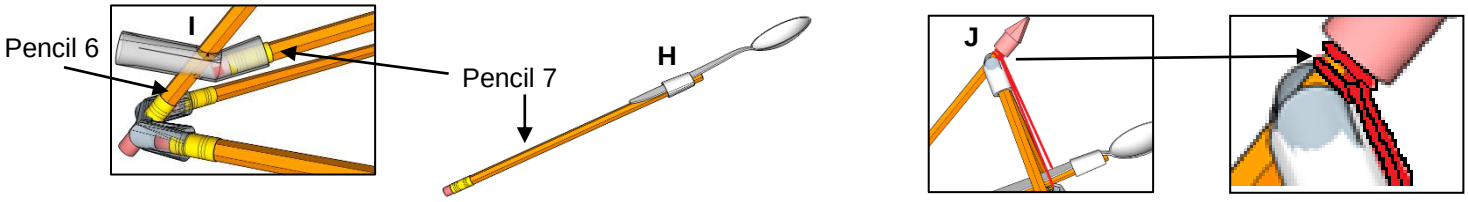



**2** Insert the end of a fourth pencil into one of the punched holes of a connector until 1/4” of the end sticks out of the connector (**C**). Repeat with a fifth and sixth pencil for the remaining 2 punched holes.




**3** Insert the free end of pencil 3 into the remaining connector opening near pencil 1 (**D**), forming a triangular base. Take another connector and insert the ends of pencils 4 and 5 into the connector (not the punched hole) (**E**). Slide the **punched hole** of another connector down pencil 6 attached to the triangular base. Slide the connector down to the junction at the other end of the pencil (**F**). Insert the end of pencil 6 into the punched hole in the connector until ½” of the pencil end sticks out of the connector (**G**). Some adjusting of the connector may be required.


**4** Insert the wider tubing without punched holes partway over the end of pencil 7 and insert the spoon handle into the tubing (**H**). Push the end over the pencil until the tubing is near the neck of the spoon. Insert the other end of pencil 7 into the connector on pencil 6 (**I**).



Content Standards:

**NGSS**

Gravity:
5-PS2-1

Definitions and Transfer of Energy:
4-PS3-1
MS-PS3-5

Forces and Motion:
3-PS2-1
3-PS2-2
MS-PS2-2

Test Variables (Engineering):
3-5-ETS1-3

# Set-Up (cont'd)

5 Loop a rubber band over the end of pencil 6 and secure with a cap eraser (see **J** on previous page). Loop the rubber band over the spoon just below the tubing. Place the triangular base at the corner of the stiff board and secure with binder clips (see title page).

# To Do and Notice

**Please review "Safe use of the Connect-A-Pult" on title page**

1 Adjust the spoon so that it faces upward. The launch angle of the spoon can be adjusted by sliding the connector up and down along pencil 6 (see title page).

2 Pull the spoon downward, place the load into the bowl of the spoon and release the spoon!

3 Try these variations, noting the effect on the load trajectory (path):

- Pull the spoon down different distances to the base.
- Pull the spoon down to the right or left before releasing.
- Use a variety of objects for the load and compare trajectories.
- Prop up a corner of the stiff board to vary the launch angle.

# The content behind the activity

A pyramid with a triangular base, a tetrahedron, makes an especially rigid, stable form. The Connect-A-Pult takes advantage of this rigidity to create a fixed point for the rubber band to pull against. Pushing or pulling on points beyond the triangular base will cause the tetrahedron to tip over, hence the need for the triangular base to be attached to the stiff board.

Catapults depend on stored energy, which is used to fling a projectile toward a target. The energy can be stored in a raised weight, twisted ropes, bent beams, or in this case, a rubber band. Scientifically, catapults are first order levers, the projectile is the load. Catapults are more complicated than simple levers because catapults must throw an object rather than lift one. The design of catapults involves simple machines.

# Learn more

- Change the size of the rubber band and observe the effect on the distance traveled by the load.
- Add more rubber band to observe the effect on the trajectory of the load.

Visit https://raft.net to view the following related activities!

Craft Stick Catapult
Staple Remover Catapult
Zippy Catapult

# Resources

- YouTube video (7:15), History of catapults - https://bit.ly/34WCV8z
- General catapult information - https://bit.ly/2RWPMlH