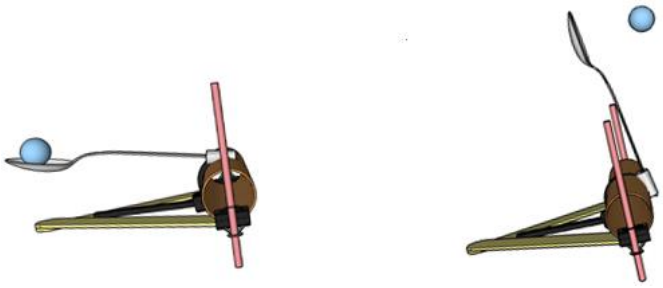
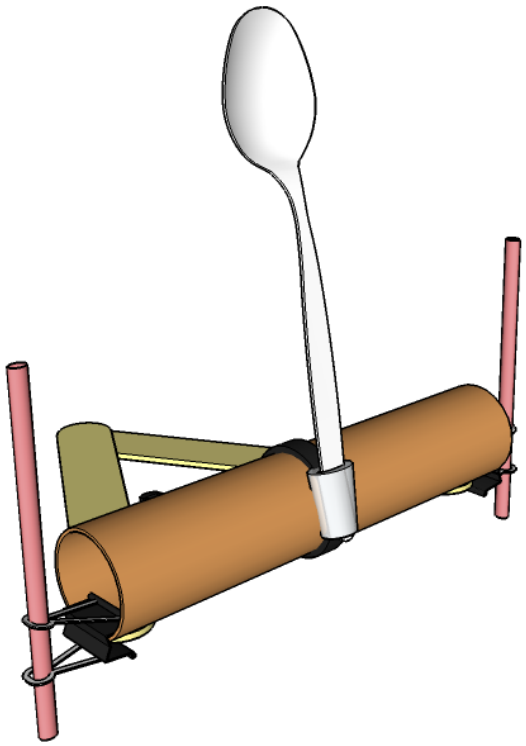
ZIPPY CATAPULT

Zip through the assembly for a quick launch!



Use a bent spoon to store the energy needed to launch an object into the air. Explore different launch angles to vary the height and distance reached by the launched object.



Curriculum topics

- Energy
- Forces & Motion
- Investigations
- Engineering/Design

Subjects

- Engineering
- Physical Science

Grade range: 3 – 8

Who we are: Resource Area for Teaching (RAFT) helps transform the learning experience by inspiring joy through hands-on learning.

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Materials

Materials in the kit may vary but generally, this kit contains the following:

- Spoon, flexible and unbreakable (1)
- Zip tie, releasable (1)
- Cardboard tube, 1” diameter (1)
- Vinyl tubing section (1)
- Binder clips, small (2)
- Craft sticks, jumbo (2)
- Plastic straw halves (2)
- Adhesive tape, double-sided (1)
- **Not included:** Objects for launching (e.g. crumpled foil, pompoms, cotton balls)

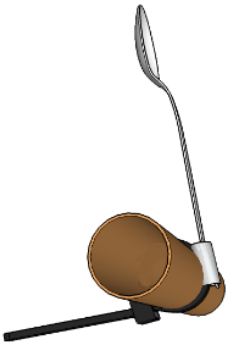
To Do and Notice

1 **Assembly:** Insert the tail end of the zip tie into the vinyl tubing. Place the zip tie so that the smooth (non-ridged) side is upward (see below, left).

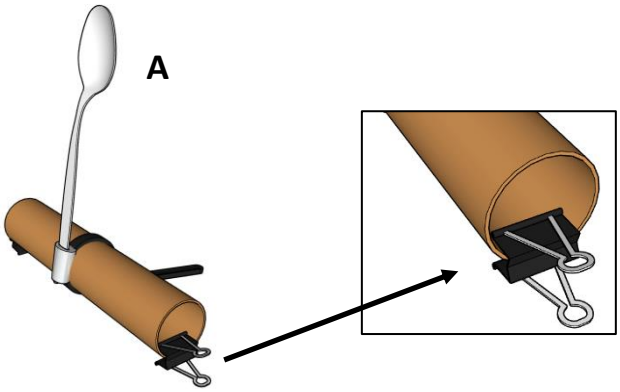
2 Insert the handle end of the spoon into the tubing starting on the side closest to the zip tie head. Continue until the spoon is tightly held in place (above, right).

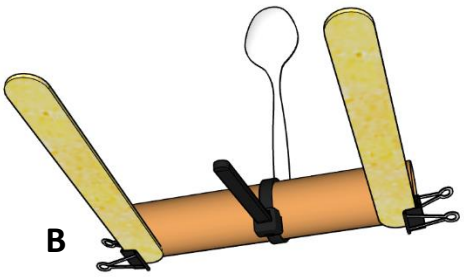
3 Wrap the zip tie around the center of the cardboard tube, with the spoon facing upward. Curl and insert the tail into the slot in the zip tie head. Pull on the tail to form a loose fit to the tube.

4 Adjust the position of the vinyl tubing until the spoon handle forms an “L” with the tail of the zip tie (see right). Pull on the tail and push on the zip tie head until clicking can be heard. This tightens the zip tie around the tube. The zip tie should be tight enough to hold the spoon in its position without slipping.

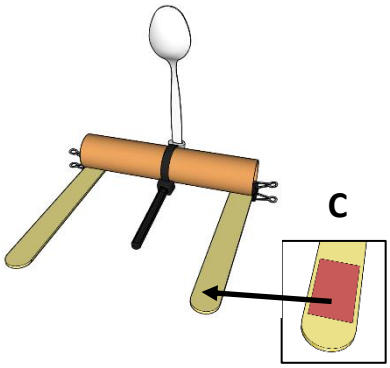


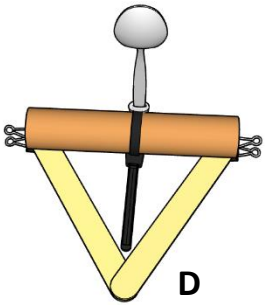
5 Attach the binder clips to each end of the tube, as shown below (**A**). Next, use the binder clips to attach jumbo craft sticks as shown (**B**), securing the craft sticks in place.

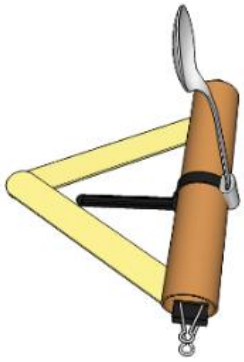




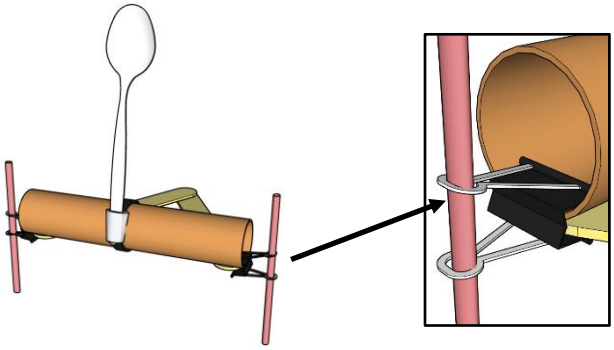
6 Trim a piece of double stick adhesive, if needed, so it fits the width of a jumbo craft stick and does not hang over the sides. Remove the release paper from the double stick adhesive and attach it to one stick (**C**). Overlap the craft stick ends so the adhesive is between them and firmly press them together, forming a triangle shape with the cardboard tube (**D**).

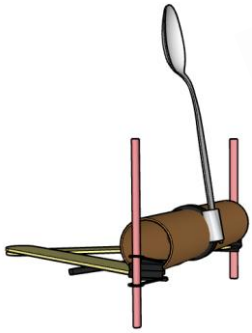




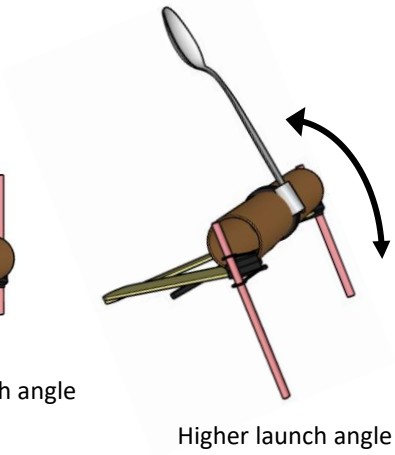


7 Insert a half straw through both loops in each binder clip (see below, left). If the straw fits loosely in the loops, wrap some tape around the straw and reinsert it into the loops. Adjust the straw positions to change the catapult height/launch angle (below, right).





Low launch angle

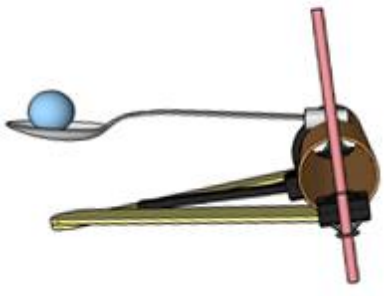


Higher launch angle

8 **Note: Supervision required. Never aim the catapult at others or towards eyes**.
Use one hand to hold down the overlapped craft sticks. With the other hand, bend back the spoon and load it with a safe object. Release the spoon to launch!

9 **Investigate:** Adjust the launch angle as needed (moving the straws or swiveling the zip tie around the tube). Fling the load over a barrier, through a hoop, and/or strike a target. Bounce it off a surface and land into a bucket. Knock over a structure or other object. The choice is yours! Measure the distance traveled by the object (range) and note the relative height (altitude) achieved.

10 **Share** student learning with RAFT! Submit photos/video via email at education@raft.net or on social media (Facebook, Twitter, Instagram).



Core Content Skills:

Science & Engineering (NGSS)

Developing and Using Models, Planning and Conducting Investigations, Forces and Motion, Definitions of Energy, Types of Interactions, Cause and Effect

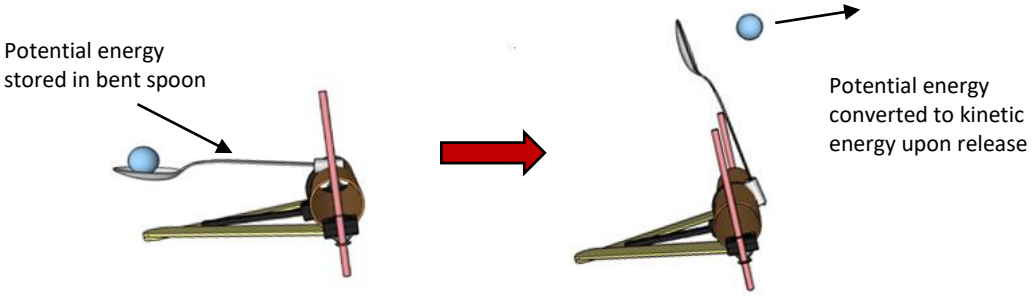
Social Emotional Learning

- Self-awareness
- Self-management
- Responsible decision-making

The Content Behind the Activity

All catapults depend on **potential** (stored) **energy**, which is used to fling a projectile (load) toward a target. The energy can be stored in a raised weight, twisted ropes, or bent beams. Historically, manual labor would be used to store the potential energy, converting the chemical energy gained from eating food into the mechanical energy stored in the catapult. Gears and levers could be used to enable the storing, over time, of smaller increments of muscle power into a larger amount stored in the device, which would be release all at once. When the load is released, the potential energy stored in the components of in the catapult is converted into the **kinetic energy** of the moving load. It's this energy that allows the load to reach and do work on targets (knock down castle walls, destroy bridges, etc.).

Scientifically, catapults are first order **levers** (a simple machine) and the projectile is the load. Catapults are more complicated than simple levers because catapults must throw an object rather than lift one. The study and design of catapults involves simple machines, Newton's second law of motion (F= ma), and angular acceleration.



Reuse

This kit uses 100% reusable materials designed for other uses. To continue making a positive impact in reducing waste, reuse these materials in other projects. Additionally, any unused materials can be collected and delivered back to RAFT.

Feedback

Please comment on this kit by taking this short survey: http://bit.ly/RAFTkitsurvey. Let us know of any material concerns (missing, broken, or poorly fitting parts) as well as any suggestions for improvement.

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

Connect-A-Pult
Craft Stick Catapults
Flingy Thingy
Staple Remover Catapult

Resources

- History of catapults - https://bit.ly/2QOM6SD
- More on trebuchets & catapults - https://bit.ly/2vRJ34V
- Simple machines - https://bit.ly/33PWT4j
- Interactive virtual catapult - https://sigmazone.com/catapult/