# Aerospace: Aerodynamics

Learn what affects aerodynamics and how an object moves through the air

**Time**

- 35 minutes for just the activity
- 1 hour and 35 minutes with building a catapult

**Activity Materials**

- Approximately 10 objects of different weights, shapes and sizes that can be launched by your catapult
- Scale to weigh objects
- 2 Different color masking tapes
- Pens pencils

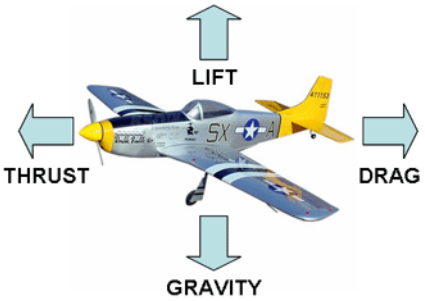
**Space Required**

Room for launching items with a catapult or outside access for launching objects with a catapult.

**Before the Meeting**

Set out objects needed for the activity. (Set up catapult if you premade it.)

## Background




Aerodynamics is the study of how objects move through the air. There are 4 forces that affect aerodynamics. They are: weight, lift, drag, and thrust.

Every object has weight. Even the smallest of atoms, hydrogen, has a weight. Gravity pulling down on an object is the cause of weight. In order to fly, an object needs something pushing it in the opposite direction with enough force to counteract the effects of gravity.

Lift is the opposite of weight. It is the amount of energy to get the object to move up. In order to move up, an aircraft must have more lift than weight. For example a helicopter's blades must move fast enough to pull the weight of the body of the helicopter up.

Drag is the force that slows an object down. This comes from air hitting the object and slowing it down. The more area the air can hit, the more it is going to slow that object down. Round and pointed surfaces have less drag than flat surfaces. If you think about cars for example, a sports car has less drag than a pickup.

Thrust is propulsion (we will cover this more in the next lesson). Thrust is the amount of energy needed to move an object forward through the air.

## Activity Instructions

Depending on the time availability you can have the member build the catapult or you can pre make the catapult.

Have a variety of objects available to launch (rock, Rubik's cube or same size cube, golf ball, ping pong ball, etc.) Have members weigh each object and record it. Launch different objects with the catapult. Make sure the catapult is the same every time something is launched. Have one member watch the flight pattern and put a piece of tape (or string if you are outside) on the ground where the object peaks and write down what object it was on the tape. Have another member watch where objects land (make sure to have them mark where it lands not where it bounces or rolls to after landing). Put a piece of different colored tape there and write on the tape what the object was.

## Reflect and Apply Questions

1. Which object went the farthest? Why?
2. Which object went the shortest distance? Why?
3. Which object weighed the most? How did that affect its flight pattern?
4. Which object had the most drag? How did that affect its flight pattern?
5. What was the thrust mechanism? Did any of the objects have something to give the lift? How could you construct something to give an object lift? What do you think the flight pattern would look like if you did have an object with lift?

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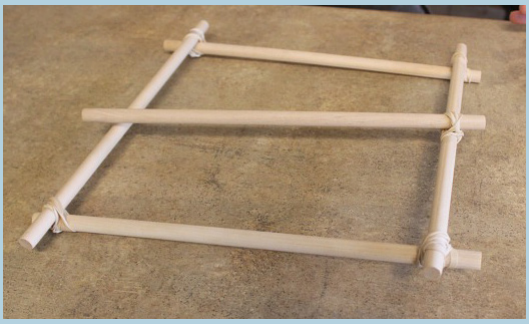
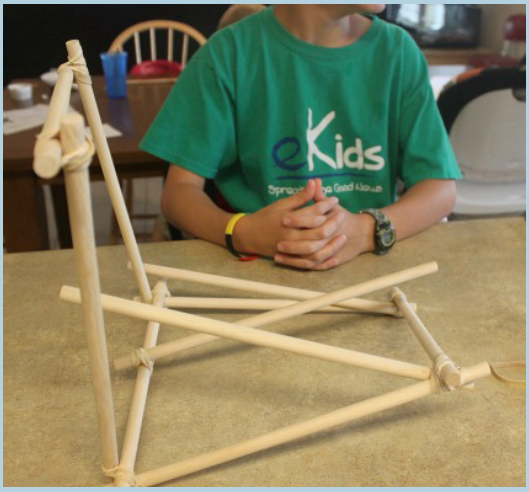
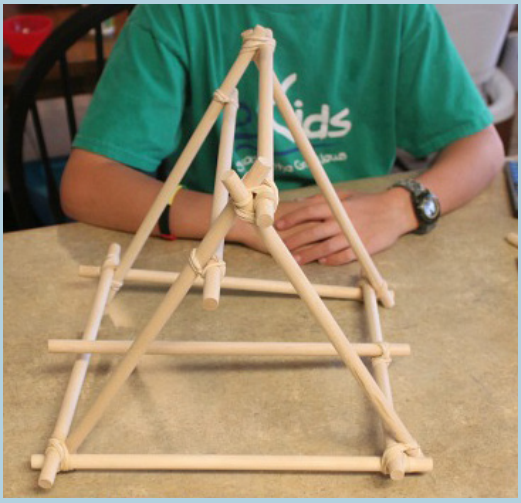






## How to make the catapult

### Materials

- 12-12inch, 3/8 inch diameter precut rods or 10 12inch rods and 1 15inch rod
- Rubber bands
- Bottom of a paper cup or something to put objects being launched in
- Hot glue

### Instructions:

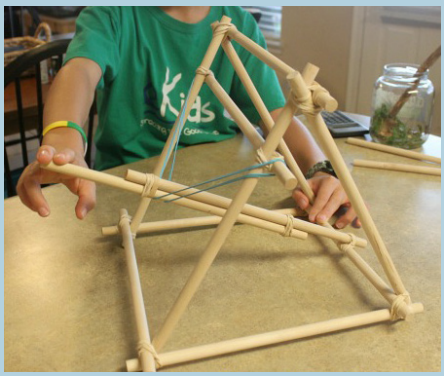
**Step 1:** Use rubber bands to make a "T" shape with two dowel rods. Then add three more rods to make the square base of the catapult, like this. (If you make the base first, you'll end up having to take it apart to add the vertical piece for the shooting arm.)

**Step 2:** Add 1 vertical rod to each corner. Add a horizontal rod at the top on the side where the shooting arm is.

**Step 3:** Add a horizontal rod to the other side, where you should currently have two loose vertical rods. Put this horizontal rod a couple of inches down from the top. Then, connect all of the vertical rods at the top with another rod as seen to the right.

**Step 4:** In order to make the shooting arm long enough, we added a second dowel rod. If you're not buying them pre-cut, you could just make that piece longer. Attach a rubber band across the horizontal rod and put the dowel rod over the top of it.

**Step 5:** Glue on your ammunition basket, and you're ready to fire!



## References:


Catapult directions from: http://frugalfun4boys.com/2013/06/06/how-to-build-a-catapult-out-of-dowel-rods-and-rubber-bands/

http://www.nasa.gov/sites/default/files/forces-5.jpg





*The University of Wyoming is an equal opportunity/affirmative action institution. Contact the County Extension Office to request special accommodations if needed to fully participate.*

LESSON 2

# Aerospace: Aerodynamics

Learn what affects aerodynamics and how an object moves through the air

REFLECT AND APPLY ANSWER SHEET

## Activiy 1 Reflect and Apply Questions

1. **Which object went the farthest? Why?**
2. **Which object went the shortest distance? Why?**
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