PAPER AIRPLANES & SLINGSHOTS

MATERIALS:

Copy Paper	Paper Clip
Rubber Band	Markers
Pre-folded Airplane	Rubberband Chain

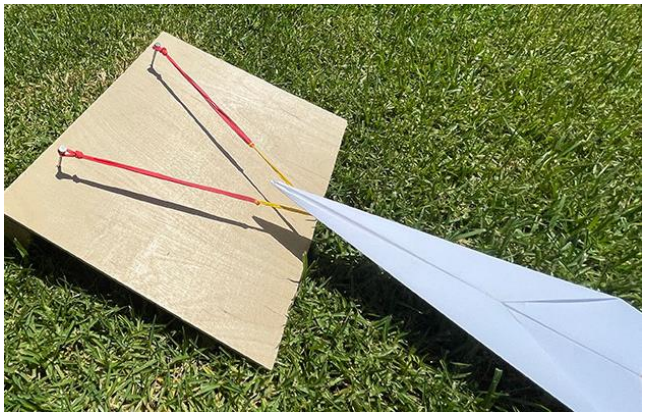
VOCABULARY:

Force	Weight	Mass	Drag
Velocity	Acceleration	Potential Energy	Energy
Kinetic Energy	Inertia	Air Pressure	Bernoulli's Principles
Aerodynamic	Nose	Wing	Accelerate

PAPER AIRPLANE FLINGER DIRECTIONS:

1. Use the attached directions to make a dart style paper airplane using the extra piece of copy paper.
2. Punch a hole through the bottom of the airplane, as in the picture. Use a hole punch if you have one, or a pair of scissors with adult supervision.
3. Loop a rubber band through the hole and tie it in a knot.
4. To launch the airplane, hold the plane with one hand and insert the index finger of the other hand in the rubber band loop. Stretch the rubber band out and release the plane.

PAPER AIRPLANE SLINGSHOT DIRECTIONS:



1. Use the pre-folded airplane in the kit. You will see a paperclip sticking out of the bottom.
2. Have two friends help hold the chain of rubberbands included in the kit. They should each hold one end and stretch the chain out straight about shoulder height. If you do not have two friends available, you can loop the ends of the rubberbands over the ends of an upside down chair or some other objects.
3. To launch the airplane, hook the paperclip over the rubberband chain around the middle. Pull back and down, then release the airplane. The rubberband chain should slingshot the airplane forward.

THE STEAM BEHIND THE EXPERIMENT:

This is a Physics and Engineering Project! Physics is a branch of science that studies matter and its motion as well as how it interacts with energy and forces. Engineering is a scientific field and job that involves taking our scientific understanding of the natural world and using it to invent, design, and build things to solve problems and achieve practical goals.

When you build and launch your paper airplane and slingshot, you learn about the basic parts of airplanes and why they are able to fly. Physics, Newton's Three Laws, Potential and Kinetic Energy, and Bernoulli's Principle explain why all airplanes can launch/fly.

Newton's Laws of Motion:

1. First Law: Law of Inertia. An object at rest will stay at rest and an object in motion will stay in motion unless a force is applied. We have to apply a force to move our airplanes- in this case we are using the slingshot. The airplane will not fly forever because gravity pulls it down and drag from pushing through the air slows it down.
2. Second Law: F=m x a. Force=Mass x acceleration. Mass is how much matter is packed into a space. Matter is anything that has mass and volume. The mass of an object determines how much force you must apply to make it move or accelerate. Our paper airplanes have a small mass, so we do not need to apply a lot of force to make them launch. If we increase the force we apply, the airplane should go further and/or faster.
3. Third Law: For every action there is an equal and opposite reaction. For our airplanes, when we pull back on the slingshot and then release, the force makes the airplane move forward.

Bernoulli's Principle: Bernoulli's Principle is the single principle that helps explain how heavier-than-air objects can fly. Bernoulli's Principle states that faster moving air has low air pressure and slower moving air has high air pressure.
Potential Energy: In physics, potential energy is the energy held by an object because of its position relative to other objects, stresses within itself, its electric charge, or other factors. In this case, it is the stored energy when the rubberband slingshot is pulled back but not released yet.
Kinetic Energy: In physics, the kinetic energy of an object is the energy that it possesses due to its motion. It is defined as the work needed to accelerate a body of a given mass from rest to its stated velocity.

MAKE IT AWESOME:

Set up a target or some containers and try to make your airplane hit the target or land in the container.

EXTENSIONS:

1. What happens when you change how much you pull back on the slingshot?
2. What happens when you change the angle of your launch?
3. What happens when you change the size or shape of the airplane?
4. What happens when you change the size of the rubber band?
5. What other changes can you come up with for this experiment?

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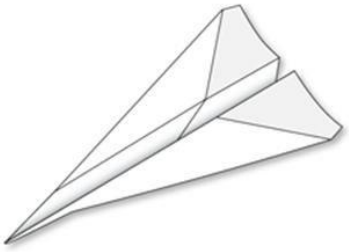
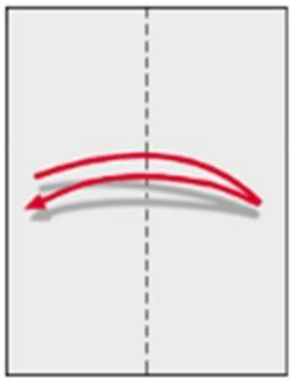
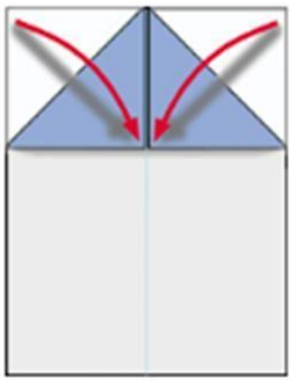
Basic Dart

Folding Instructions





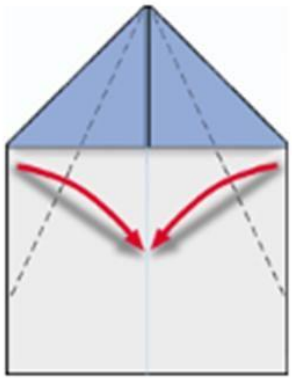
Step 1



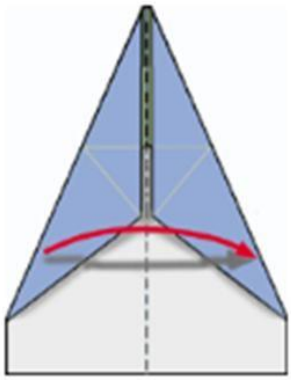
Step 2

Step 1.
Use a sheet of 81/2-by-11 inch paper. Fold the paper in half lengthwise and run thumbnail along the fold to crease it sharply. Now, unfold the paper.

Step 2
Fold down the top corners as indicated by the arrows.



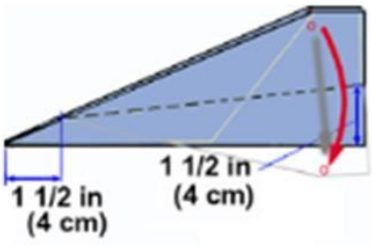
Step 3



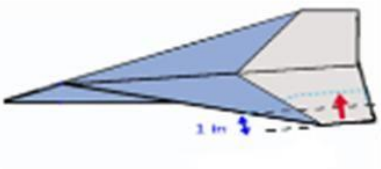
Step 4

Step 3
Fold the two edges toward the center line, as indicated.

Step 4.
Make a valley fold in half. Turn the plane 90 degrees as shown in figure of Step 5.



Step 5



Step 6

Step 5
Create a wing crease that begins at the nose as shown.

Step 6.
Form 3-dimensional shape as shown in figure. The Basic Dart is complete.
Bend up the tailing edge of the wings for lift if it has a tendency to nose-dive.