



May Dose of Discovery: Week 2

Living Room Science: Aerodynamics



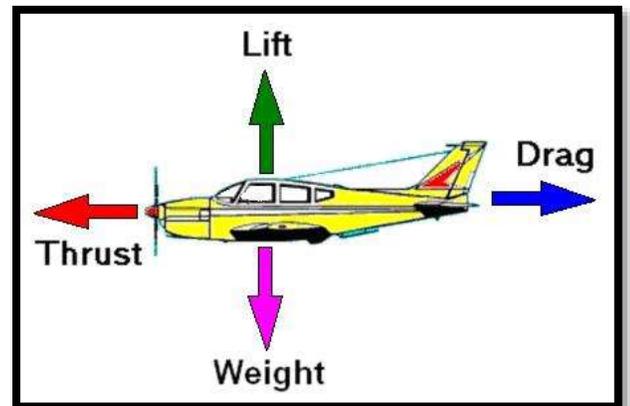
Learning Points:

- Children will be able to have fun and experiment with how different designs of planes, helicopters, and kites affect how the air interacts with their designs (aerodynamics).
- Children will be able to experience the changes that direction, lift, weight, and design can have on how well things can get from one place to the other.
- Children will also be able to see how we can use the power of aerodynamics to get work done.
- These activities can be done all in one afternoon or broken up in the week or weekend, as desired.

Background Information:

Aerodynamics is the way air moves around things. The rules of aerodynamics explain how an airplane is able to fly. Anything that moves through air reacts to aerodynamics. A rocket blasting off the launch pad and a kite in the sky react to aerodynamics. The four forces of flight are *weight*, *lift*, *drag* and *thrust*. These forces make an object move up and down, and faster or slower. The amount of each force changes how the object moves through the air.

- **Weight** is a force that comes from gravity pulling down on objects. To fly, an aircraft needs something to push it in the opposite direction from gravity. The weight of an object controls how strong the push must be.
- **Lift** is the push that lets something move up. It is the force that is the opposite of weight. Everything that flies must have lift. For an aircraft to move upward, it must have more lift than weight. A hot air balloon has lift because the hot air inside is lighter than the air around it. A helicopter's lift comes from the rotor blades at the top of the helicopter. Their motion through the air moves the helicopter upward. Lift for an airplane comes from its wings.
 - **How Do an Airplane's Wings Provide Lift?** The shape of an airplane's wings is what makes it able to fly. Airplanes' wings are curved on top and flatter on the bottom. That shape makes air flow over the top faster than under the bottom. So, less air pressure is on top of the wing. This condition makes the wing, and the airplane it's attached to, move up.
- **Drag** is a force that tries to slow something down and makes it hard for an object to move. It is harder to walk or run through water than through air because water causes more drag than air. The shape of an object also changes the amount of drag. Most round surfaces have less drag than flat ones. The more air that hits a surface, the more drag it makes.
- **Thrust** is the force that is the opposite of drag. Thrust is the push that moves something forward. For an aircraft to keep moving forward, it must have more thrust than drag. A small airplane might get its thrust from a propeller. A larger airplane might get its thrust from jet engines. A glider does not have thrust. It can only fly until the drag causes it to slow down and land.



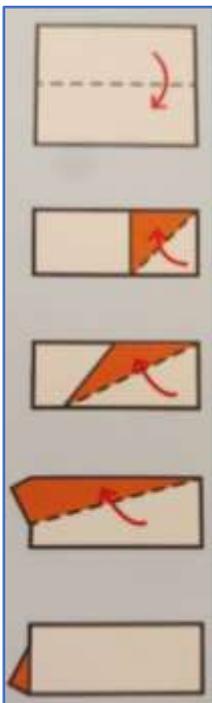
-Sandra May, *NASA Knows!* (Grades K-4)

Materials:

- Making Paper Airplanes and Gliders
 - Several pieces of paper; paper clips
- Making Paper Helicopters
 - Several pieces of paper; paper clips; scissors
- Aerodynamics at Work
 - Several pieces of cardstock; scissors; 1 straw; paper towel roll or other long, cardboard tube; thumbtacks; pencil; fan or hairdryer
 - String; small, lightweight object (pencil sharpener, pen cap, etc.); empty carton (yogurt, piece of egg carton cut out, etc.); paperclips or other small, lightweight object

Activities:

Make a Paper Airplane: Lift Off!



Step 1: Fold a rectangle of paper in half, following the direction of the arrow in the first picture. Fold the bottom right-hand corner up to the top edge. Fold the new flap up to the top edge, like in the 3rd picture. Then, fold it up once more. Turn the paper over and repeat the above procedure on that side. Open out the wings a little and see how it flies!

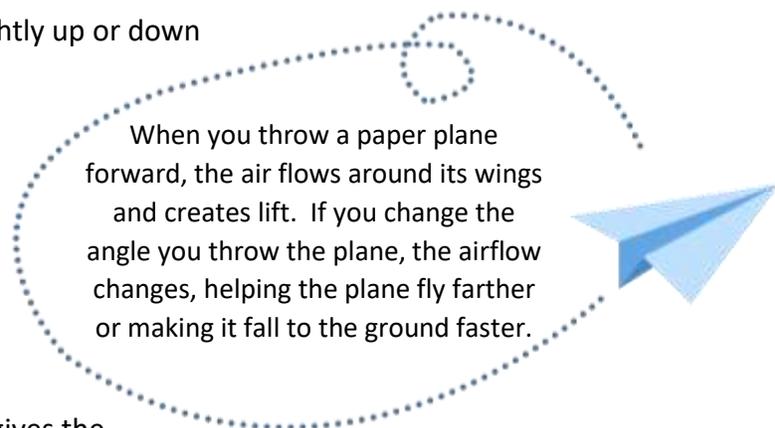
Step 2: Try aiming your plane slightly up or down as you throw it.

How does it fly?

Step 3: Attach a paper clip to the nose of your plane.

Does it change the way the plane glides?

The extra weight of the paperclip gives the plane more forward force, helping it to fly farther!



Step 4: Fold the tips of your plane's wings up and throw the plane again. Then try pointing them down instead.

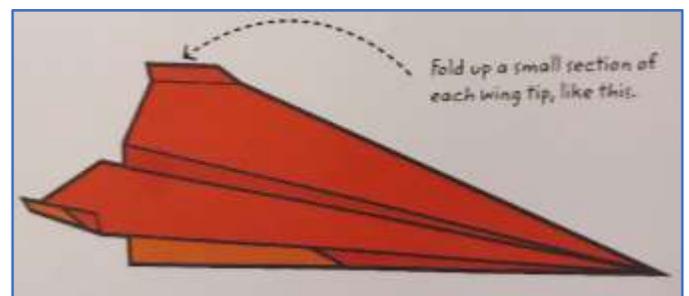
Does it fly differently?

Step 5: Point one wing tip up and one wing tip down.

Which way does the plane fly?

Now try it the other way. The wing tips change the way the air catches the wings. When the wing tips point up, the plane tilts up. When they point down, it tilts down.

And if one points up and one points down, the plane will swoop sideways!

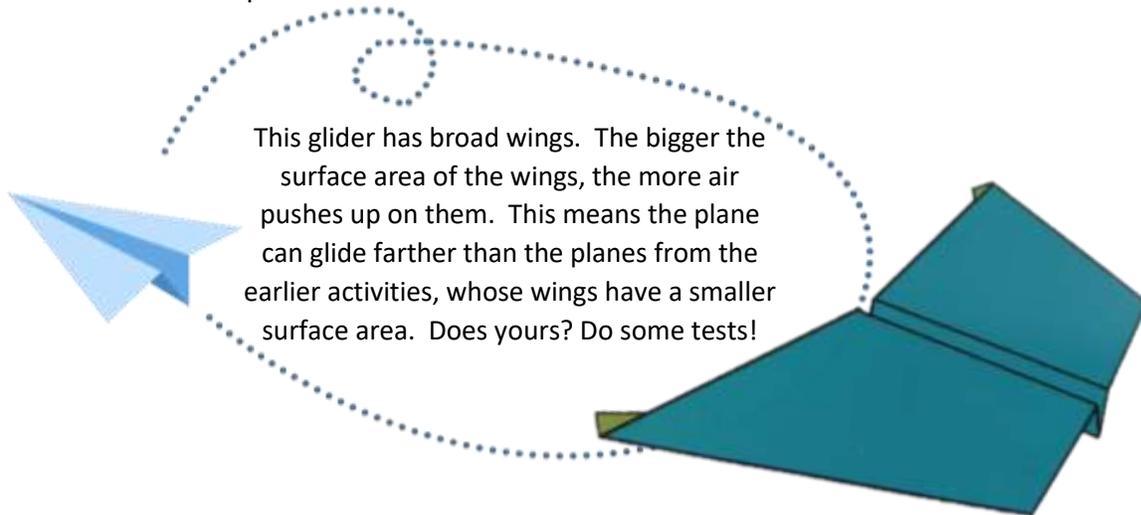


Make a Glider: Surface area and Aerodynamics

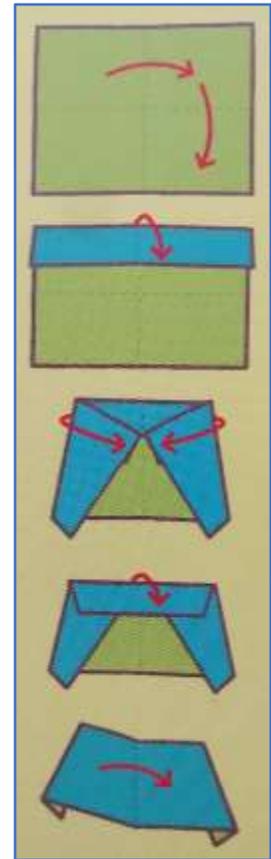
Step 1: Fold a rectangle of paper in half, length-ways and width-ways. Then, unfold it again. Fold the top part down, like in the 2nd picture.

Step 2: Fold in both upper corners so that they meet in the middle. Fold the top down again, like in the 4th picture.

Step 3: Turn the plane over and fold it in half then fold back both wings, like in the 5th picture.

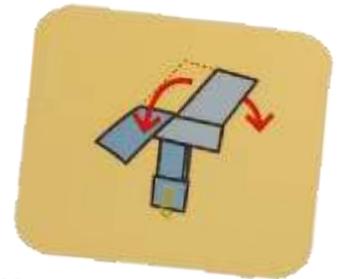
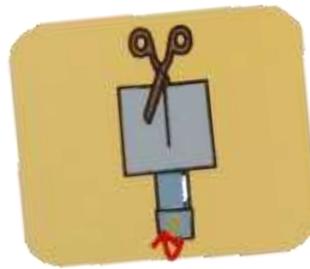
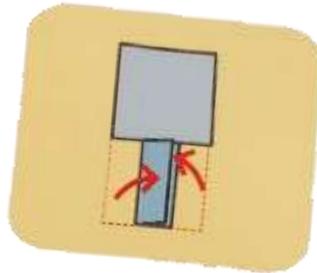
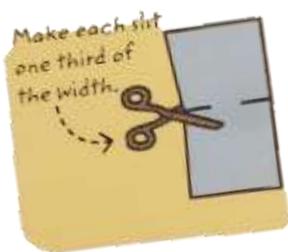


This glider has broad wings. The bigger the surface area of the wings, the more air pushes up on them. This means the plane can glide farther than the planes from the earlier activities, whose wings have a smaller surface area. Does yours? Do some tests!



Make a Paper Helicopter: How do we get things spinning?

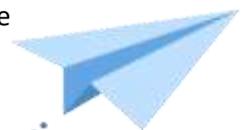
Step 1: Cut a rectangle of paper; twice as long as it is wide. Cut two slits halfway down, like in the 1st picture. Fold in the two sides below the cuts to make a strip, like in the 2nd picture. Fold up the end of the strip and secure it with a paperclip. Then, cut a slit down the top, stopping before the middle. Fold one part of the top to the front, and the other to the back, like in the 4th picture. Hold your helicopter up high and let go.



What happens?

Step 2: Try trimming the blades with scissors to make a helicopter with shorter blades... or cut slits lower down the paper to make a helicopter with longer blades, to compare how they fall.

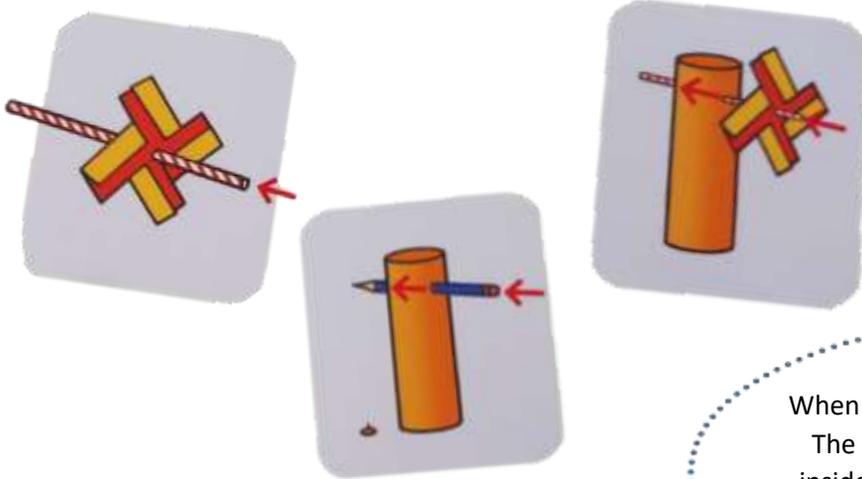
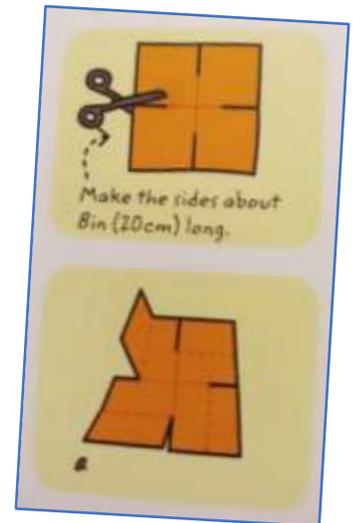
As the helicopter falls, air pushes against its blades (wings), making them turn in opposite directions. This makes the helicopter spin. A helicopter with shorter blades spins and falls faster. A helicopter with longer blades stays in the air longer.



Aerodynamics at Work: Paper Pinwheels with a Load!

Step 1: To make a square sail, draw a cross on a square of cardstock. Cut a slit a square of the way along each line. Fold every other side up toward the middle. Make a small hole in the middle with a sharp pencil. Push a straw through the hole, so it fits tightly.

Step 2: Use a thumbtack to make two holes opposite each other at the top of a paper towel roll. Twist a pencil in the holes to make them slightly bigger. Push the straw through both holes. Can you make the straw turn by blowing on the pinwheel sail with your own breath or a fan/hairdryer.



Step 3: Take the pinwheel and tie a piece of string to the straw, as shown in the picture. Tie the other end of the string to a small, light object, such as a pencil sharpener. Blow on the sail and see what happens!

Now tie an empty carton to the end of the string. Put some paperclips into the carton and see how much the pinwheel can lift when you blow on the pinwheel. Try using your own breath and then a fan or hair-dryer

When the sail turns, the straw turns too. The straw works like a shaft, or pole, inside a traditional windmill. The shaft was used to turn huge millstones to grind brains of wheat into flour.

As the sail turns, the straw turns and winds up the string, lifting the object. This shows how wind power can be used to lift or move objects!

