

## **Aerodynamics**

Have you ever wondered how planes fly? The answer is **aerodynamics**. Aerodynamics is the way air moves around things. Anything that moves through the air reacts to aerodynamics. A rocket blasting off the launch pad and a kite in the sky react to aerodynamics. Aerodynamics even acts on cars, since air flows around cars.

The four forces of flight are lift, drag, weight, and thrust. An airplane flies when all four forces work together. These forces make an object move up and down, and faster or slower.

*Lift* moves the airplane upward and is **generated** by the forward motion of the airplane through the air. The most *Lift* comes from the wings. Drag is the force created by the resistance of the air that slows the airplane down. You can feel drag when you walk against a strong wind. If you swish your hand rapidly side-to-side, you will feel that resistance on your hand. Weight is the force created by the pull of gravity toward the center of the earth. You will feel the effect of this force if you jump up from the floor. Weight is the force that pulls the airplane toward Earth.

Airplanes are built so that their weight is spread from front to back. This keeps the airplane balanced. Thrust is produced by the engine. It is greater than the force of *Drag* and helps the airplane move forward. Engines give thrust to airplanes. When the forward motion is enough to produce a force of *Lift* that is greater than the Weight, the airplane moves upward.

### **LINE SETS**

**Choose the line set that best captures the meaning of the whole text.**

#### **Line Set 1**

Kites react to aerodynamics.

A rocket blast has aerodynamics.

#### **Line Set 2**

Aerodynamics works on planes.

Aerodynamics works on cars.

#### **Line Set 3**

Lift moves an airplane upward

Weight brings a plane down.

#### **Line Set 4**

Aerodynamics is the way air moves around things.

Four forces help an object move through the air.

## Paper Airplanes

Have you tried with a friend to see whose paper airplane can fly the farthest or highest? If so, you were becoming an engineer right before your eyes. Engineers make small model airplanes to test their ideas in a laboratory before they build the real thing. Building a model allows engineers to test their ideas using less expensive materials. The "real thing" is built out of its final and more expensive materials. Engineers run airplane models through thousands of tests before **constructing** the real thing.

The forces that allow a paper airplane to fly are the same ones that apply to real airplanes. Many factors affect how airplanes fly. Paper airplanes are also called gliders. Engineers consider these factors when designing airplanes for speed, distance, and cargo.

When you throw a paper plane in the air, you are giving the plane a push to move forward. That push is a type of force called thrust. While the plane is flying forward, air moving over and under the wings provides an upward lift force on the plane. At the same time, air pushing back against the plane is slowing it down, creating a drag force. The weight of the paper plane also affects its flight, as gravity pulls it down toward Earth. These forces - thrust, lift, drag and gravity - affect how well a paper plane flies.

The basic shape of a paper airplane includes wings and a body. The wings allow a plane to "sit" on the air. The wings compress the air **molecules** under the wings. This creates higher pressure than the air above the wings. The air above the wings has lower pressure. The wings build on the higher air pressure. This helps the paper airplane fly. Engineers take these ideas or concepts into consideration when building airplanes. They start by building paper models. By creating paper airplanes, you are being an aerodynamics engineer. The next time you make a paper airplane, consider how aerodynamics affect flight.

### LINE SETS

**Choose the line set that best captures the meaning of the whole text.**

#### Line Set 1

Engineers make small-scale airplanes.

Airplanes are also called gliders.

#### Line Set 3

Engineers build paper planes before building real planes.

Aerodynamics work on paper airplanes.

#### Line Set 2

Airplanes are different from paper planes.

Paper planes have wings like real planes.

#### Line Set 4

Engineers do many things.

Engineers build paper airplanes.

Building meaning: fly, aerodynamics, forces, slower

Aerodynamics- Line set 4

Paper Airplanes- Line set 3