**Air in Motion**

**Curriculum Links:**

AW2.1 Investigate properties of air and water (in all three states of matter) within their environment. [SI, TPS

AW 2.2 Assess the importance of air and water for the health and survival of living things, including self, and the environment. [CP, DM]

FL6.1 Examine connections between human fascination with flight and technologies and careers based on the scientific principles of flight. [CP, DM, SI]

FL6.2 Investigate how the forces of thrust, drag, lift, and gravity act on living things and constructed devices that fly through the air. [SI]

**Science Background:**

An object in flight is constantly engaging in a tug of war between the opposing forces of lift, weight (gravity), thrust and drag. Flight depends on these forces – whether the lift force is greater than the weight force and whether thrust is greater than drag (friction) forces.

Lift and drag are considered [aerodynamic](http://sciencelearn.org.nz/About-this-site/Glossary/aerodynamics) forces because they exist due to the movement of an object (such as a plane) through the air. The weight pulls down on the plane opposing the lift created by air flowing over the wing. Thrust is generated by the [propeller](http://sciencelearn.org.nz/About-this-site/Glossary/propeller) (engine) and opposes drag caused by air resistance. During take-off, thrust must counteract drag and lift must counteract the weight before the plane can become airborne.

If a plane or bird flies straight at a [constant speed](http://sciencelearn.org.nz/About-this-site/Glossary/constant-speed):

* lift force upwards = weight force downwards (so the plane/bird stays at a constant height)
* thrust force forwards = opposing force of drag (so the plane/bird stays at a constant speed).

If the forces are not equal or balanced, the object will speed up, slow down or change direction towards the greatest force.

For example, if a plane’s engine produces more thrust, it will accelerate. The acceleration increases air speed past the wing, which increases lift so the plane gains altitude. Then, because the plane is moving faster, drag (air resistance) is increased, which slows the plane from speeding up as quickly until thrust and drag are equal again. The plane can now remain at a constant but greater height.

A plane can lose altitude by reducing thrust. Drag becomes greater than thrust and the plane slows down. This reduces lift and the plane descends.

Airplane wings are shaped to make air move faster over the top of the wing. When air moves faster, the pressure of the air decreases. So the pressure on the top of the wing is less than the pressure on the bottom of the wing. The difference in pressure creates a force on the wing that [lifts](https://www.grc.nasa.gov/www/k-12/airplane/right2.html) the wing up into the air.

Bernoulli's principle states that as the speed of a moving fluid increases, the pressure within the fluid decreases. Like all gases, air is considered to be a fluid. When air moves, such as when students blow air, the pressure of the air decreases. The area of stationary air surrounding the moving air has a higher pressure than the moving air does. Objects can be pushed from the area of still air into the area of moving air. This push is often described as a pull into the area of low pressure. This description is incorrect because air pressure pushes objects; it does not pull them.

**Materials:** thin strip of paper, index cards, thick straws, pencil, paper, compass, scissors, glue or tape, ping pong ball, 30 straws, 2 empty pop cans, ruler

**Directions:**

Set up the stations according to the instructions in the textbook, and have student move through the stations, experiencing air pressure and its effects on objects (Bernoulli’s Principle).

Stations include:

1. Levitating with lips (when you blow above the paper, it lifts up)
2. Moving air (when you blow beneath the card, the cards pulls down)
3. Floater ball (when you blow past the ball the ball pulls down)
4. Uncanny movements (when you blow between the cans, the cans move toward each other)
5. Temporary attraction (when you blow between two paper strips they move toward each other)

**Inquiry Questions:**

**Source:** Pearson Saskatchewan Science 6 page 188-192, <http://sciencelearn.org.nz/Contexts/Flight/Science-Ideas-and-Concepts/Principles-of-flight> , <https://www.grc.nasa.gov/www/k-12/UEET/StudentSite/dynamicsofflight.html>