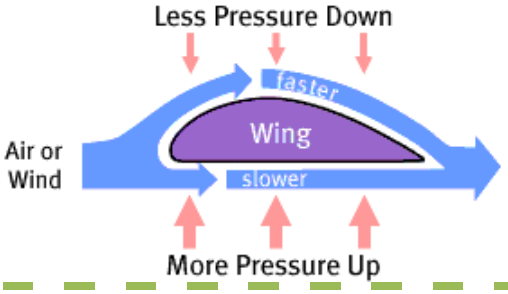
Name:

Structures of FLIGHT (Teacher Version)

High-Pressure Performance

Think about the demo your teacher did at the start of the lesson. Based on what you observed, can you explain what is happening to the airplane wing in the picture?

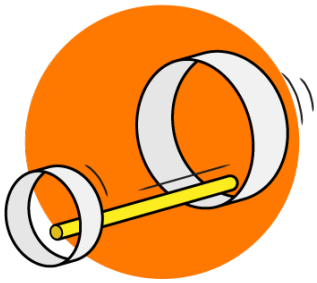


This phenomenon is known as **Bernouilli's Principle**!

Let's Build a Hoopglider!

Materials:

- Plastic drinking straws
- Sheet of thick paper
- Scotch tape
- Scissors



Instructions:

1. Cut off two strips of thick paper, one longer than the other.

2. Tape each into a ring, one to each end of the straw.

3. Hold the glider in the middle, hoops up and small hoop in front. Throw like a javelin.

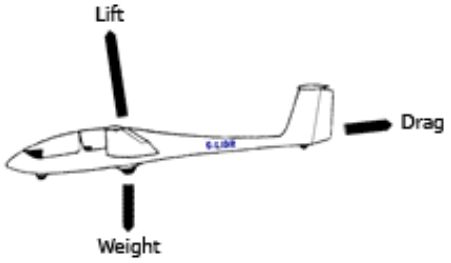
Explore! *Try 2 different glider designs!*
Does the longer of straw make it go farther?
Do more hoops make it fly farther?
Do the hoops have to be lined up?

Forceful Flying

The diagram here shows the different forces on an airplane and on a glider. The difference between the two is that the airplane has a source of **thrust** for sustained flight, while a glider does not.

Can you identify where each force on both the airplane and the glider comes from?

	Airplane	Glider
Thrust:	*Propeller*	*None*
Lift:	*Air*	*Air*
Drag:	*Air*	*Air*
Weight:	*Plane Mass*	*Glider Mass*



Sources: Hauser, Jill. Gizmos & Gadgets. Charlotte: Williamson Publishing Co., 1999. Print.
Wood, Robert. Science For Kids. Blue Ridge Summit: Tab Books, 1992. Print.

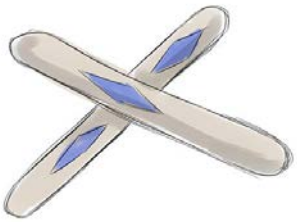
Name:

Let's Build a Boomerang!

Materials:

- Pencil
- Cereal box card board
- Rubber bands
- Scissors



Instructions:

1. Sketch two of the same kind of arm onto cardboard.

2. Cut out your sketched arms. Use rubber bands to connect the arms.

3. Fling your boomerang parallel to the ground like a Frisbee, or hold it vertical to the ground and snap your wrist to release it.

Explore!
Does the boomerang work better with one, two, or three arms?
Which arm design works best?
Does symmetry play a role?

Talk About It!

1. What are some similarities you notice about the design of real glider wings and boomerangs?
*They have a thickness and a curvature similar to the wing in the first diagram of page 1. This wing design gives the boomerang **lift**, as discussed earlier.*

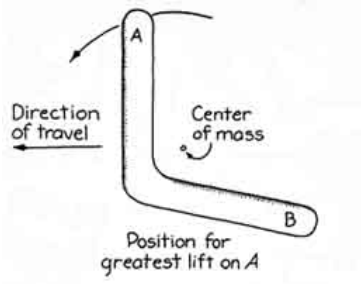
2. For the unsuccessful throws, what property of air caused the boomerang or glider to fall back down to the Earth?
***Drag** or air friction slows both structures down, but if not thrown properly, this can cause them to slow down enough to lose their lift and fall.*

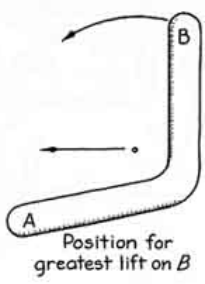
3. List some of the internal forces in the glider as it is airborne:
Torsion, shear, compression.

Centre of Mass

-Locate the centre of mass on a boomerang and an Aerobie™. How are they similar?
They are both located outside of the actual structures.

-Based on the diagram, describe how a boomerang maintains its lift as it flies:
As it rotates, each end experiences maximum lift. This keeps the overall lift of the boomerang high enough to stay airborne.





Sources: Hauser, Jill. Gizmos & Gadgets. Charlotte: Williamson Publishing Co., 1999. Print.
Wood, Robert. Science For Kids. Blue Ridge Summit: Tab Books, 1992. Print.