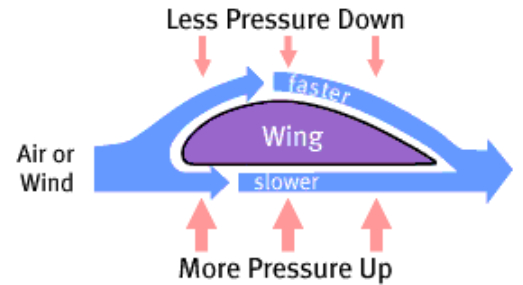


Name:

# Structures of FLIGHT

## 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?

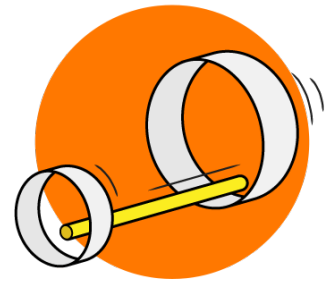


This phenomenon is known as **Bernoulli's Principle!**

## 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?

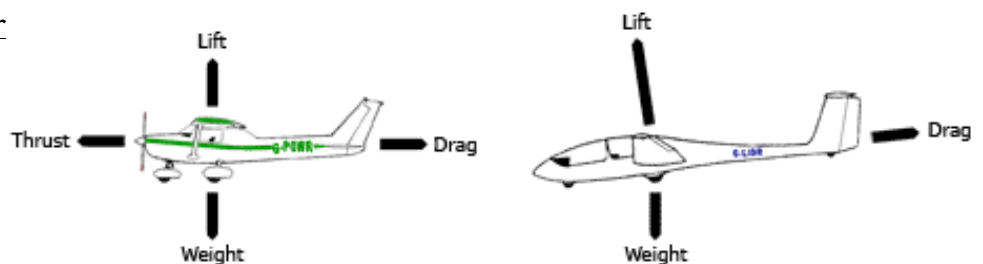
Thrust: Airplane

Glider

Lift:

Drag:

Weight:

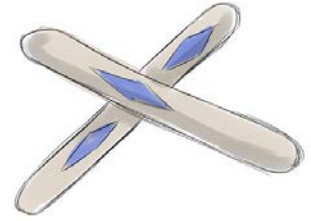


Name: \_\_\_\_\_

## 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?



2. For the unsuccessful throws, what property of air caused the boomerang or glider to fall back down to the Earth?

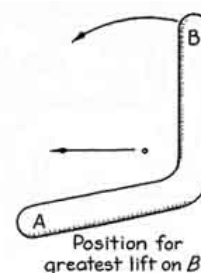
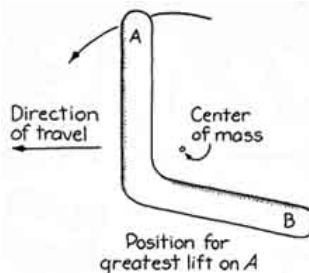


3. List some of the internal forces in the glider as it is airborne:

### Centre of Mass

-Locate the centre of mass on a boomerang and an Aerobie™. How are they similar?

-Based on the diagram, describe how a boomerang maintains its lift as it flies:



Name:

## **Image Sources:**

### **High-Pressure Performance:**

1. Info Use: <http://infouse.com/planemath/activities/pmenterprises/forces/forces4.html>

### **Let's Build a Hoopglider:**

1. 4Vector: <http://4vector.com/free-vector/free-vector-vector-clip-art-scotch-tape-roll-clip-art-114505>
2. 4Vector: <http://4vector.com/free-vector/free-vector-vector-clip-art-scissors-clip-art-116113>
3. Amazon: <http://www.amazon.com/SunWorks-Smart-Stack-Construction-Inches-Colors/dp/B0013NVA7K>
4. Bulk Bar Products: <http://bulkbarproducts.com/products/Straws>
5. Fruit Burst: <http://www.fruit-burst.co.uk/fun-and-games/experiment/hoop-glider>

### **Forceful Flying:**

1. Pilot's Web: <http://www.pilotsweb.com/principle/forces.htm>

### **Let's Build a Boomerang:**

1. FotoSearch: <http://www.fotosearch.com/illustration/cereal.html>
2. 4Vector: <http://4vector.com/free-vector/free-vector-vector-clip-art-scissors-clip-art-116113>
3. Clker: <http://www.clker.com/clipart-red-rubber-band.html>
4. Clipart Pal: [http://www.clipartpal.com/clipart\\_pd/education/pencil1.html](http://www.clipartpal.com/clipart_pd/education/pencil1.html)
5. Wikihow: <http://www.wikihow.com/Make-a-Boomerang>

### **Talk About It:**

1. Outdoor Sport & Leisure: <http://www.outdoor-sport-leisure.net/flying.htm>
2. Culture Quest: [http://www.culturequest.us/aboriginal\\_tools/boomerang.htm](http://www.culturequest.us/aboriginal_tools/boomerang.htm)

### **Centre Of Mass:**

1. Jesse Enterprises: <http://jesseenterprises.net/amsci/1979/04/1979-04-body.html>
2. Aerobie: <http://aerobie.com>