



# Principles of Flight



## Lesson Plan: Boomerangs Keep Coming Back

**Grade Level:** 7-8

**Subject Area:** Science

**Time Required:** *Preparation:* 30 minutes  
*Activity:* 1 hour

### National Standards

#### Correlation:

*Science (grades 5-8)*

- Science as Inquiry Standard: Understanding about scientific inquiry.
- Science as Inquiry Standard: Understanding about scientific inquiry.
- History and Nature of Science Standard: Nature of Science.
- Unifying Concepts and Processes Standard: Evidence, models and explanation.
- Physical Science Standard: Motions and forces.

**Summary:** Students will determine the flight characteristics of a paper boomerang by studying the flight variables associated with lift and drag.

#### Objectives:

Students will:

- Determine the effects of changing airfoil shape on flight path
- Determine the throwing style for maximum flight
- Compare the flight variables that change when weight is added to an airfoil

#### Background:

Each airfoil of the boomerang has a leading and trailing edge. Lift is generated over the entire top surface, but in proportion to the relative air velocity. As it spins, the wing at the top of the rotation has a greater air speed than the airfoil at the bottom of the rotation. These unequal forces result in two actions: the boomerang will shift from vertical to horizontal because of the greater force on the upper airfoil and precession causes the boomerang to move in a circular path. As the boomerang turns to the right or left (right-handed boomerangs travel and spin with counterclockwise rotation and direction and left-handed boomerangs travel and spin with clockwise rotation and direction), the boomerang will move from vertical to horizontal until precession becomes minimal and the boomerang finishes its flight.

#### Materials:

You will need:

- Tag board (card stock, file folder or paper plate)
- Scissors
- Masking tape
- Safety glasses (optional)



**Safety Instructions:** Use caution when flying the paper boomerangs. Create a single direction flight zone. Be sure that students stop flying their boomerangs when other students are retrieving boomerangs that have already landed.

**Procedure:**

**A. Warm-up**

1. Review the concept of the four forces of flight, emphasizing lift and drag.
2. Explain the flight of a boomerang and demonstrate how it flies. (Practice and refine your own technique before using this lesson with students.)
3. Explain the tuning process by bending the wings just a little (uniformly on each airfoil). Too much bend will cause greater drag and slow the rotation. Just a slight bend is needed.

**B. Activity**

1. Trace the master pattern on the tag board and cut it out.
2. Bend to tune for test flight.
3. Go to a large open indoor area (such as the gymnasium). Create a clear test area and allow students to fly the boomerangs one at a time.
4. To fly the boomerang, hold the boomerang vertically. Make a fist and hold one blade between your thumb and index finger. Bend your wrist back, so the boomerang nearly touches your forearm. Snap your wrist, spinning the boomerang straight out in front of you and releasing at eye level with your arm fully extended. The boomerang should be vertical, straight out from your body.
5. Change the bend of the airfoils and note the results.
6. Add a 4 cm strip of masking tape to one airfoil. Note the change in flight path. Continue to add masking tape to another airfoil and note the change in flight path.

**Assessment/  
Evaluation:**

Students will report and discuss their findings.

**Resources/  
References:**

Broadbent Boomerangs, 3204 38th St. NW, Canton OH 44718

U.S. Boomerang Association, P. O. Box 182, Delaware OH 43015



# Boomerang Pattern

