# Tumblewing Gliders

EAA eActivities

Name: _____ Date: _____

## Lesson Focus

This lesson focuses on Newton's laws of motion and Bernoulli's principle. It also touches on the four forces of flight (thrust, drag, lift, and gravity) and how changes in design can affect performance.

## Keywords

Define the following:

**Axis:**

**Thrust:**

**Drag:**

**Lift:**

**Gravity:**

**Bernoulli's principle:**

**Newton's laws of motion:**

## How Does a Tumblewing Work?

A tumblewing, like any object that flies, uses the four forces of flight. The four forces of flight are **lift, thrust, gravity,** and **drag.** Lift must overcome gravity and thrust must overcome drag for an object to stay airborne. You will notice that if you just drop your tumblewing, it will slowly fall to the floor, spinning around its axis, because the force of gravity is stronger than the tumblewing's lift. But, if you walk behind it with a piece of cardboard to create a ridge of air for the tumblewing to ride on (called ridge lift), the air provides both the upward lift and the forward thrust. With these two forces balanced, the tumblewing can fly forward.

## Materials for Each Group

1. Template for tracing wing
2. Pencil
3. Scissors
4. Tracing or similar lightweight paper
5. Sheet of cardboard, 30 cm by 30 cm minimum

**Pre-Lab Questions:** Please use complete sentences with correct punctuation.

1. What part of an airplane usually provides the lift?

2. What part of an airplane usually provides the thrust?

3. After reading how a tumblewing works, explain in your own words how lift and thrust will be provided to the tumblewing.

## Procedure

### Building

1. Trace the template onto the tracing paper.
2. Cut out the wing.
3. Fold the ends of the wing up at 90 degrees.
4. Bend the leading edge up slightly.
5. Bend the trailing edge down slightly.

### Flying

1. Hold the cardboard at 30 degrees with the top closest to you.
2. Release the wing over your head and walk toward the wing, keeping it aloft.

After flying the template model to get the hang of it, record your best distance. Discuss some modifications you might make to the design. See if you can increase the flying distance.

**Independent Variable:**_____.

**Dependent Variable:**_____.

**Hypothesis:** By changing the _____to _____

on the tumblewing, the tumblewing will fly farther, because _____

_____.

Test your new design at least three times. Then try another change.

## Data

**Sample Data Table:** Best flight with template wing _____

| Trial | Distance traveled (m) | Observations |
|---|---|---|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |

**Present your conclusion to your peers. What was the best flight you had and why based on your data.If you had more time and unlimited materials, what would you test next?**

## Questions

1. How does Bernoulli's principle figure into this lab?

2. Why did one wing type work better than another?