



# Principles of Flight



## Lesson Plan: Controlling Flight: Rudders, Ailerons, And Elevators

**Grade Level:** 5

**Subject Area:** Science

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

**National Standards Correlation:**

*Science (grades 5-8)*

- Science as Inquiry Standard: Abilities necessary to do scientific inquiry.
- History and Nature of Science Standard: Nature of science.
- Unifying Concepts and Processes Standard: Evidence, model and explanation.
- Unifying Concepts and Processes Standard: Change, constancy, and measurement.

**Summary:** Students will construct paper gliders and conduct a series of test flights to discover how the rudder, elevators and ailerons affect flight. Students will measure distances flown and use a stopwatch to determine time aloft for each glider flight.

**Objectives:** Students will:

- Construct a glider
- Predict and observe how the rudder, aileron and elevator affect flight
- Measure distance flown
- Use a stopwatch to determine time aloft

**Background:** The rudder on the vertical fin steers the plane right or left. This is referred to as yaw. An elevator points the nose of the plane up or down. This is the pitch of the plane. Ailerons help to keep the plane steady and assist in tilting it while making a turn so that the wing on one side is lower than the wing on the other side. This is referred to as roll.

**Materials:** Each student will need:

- Glider pattern
- Heavyweight paper
- Straw
- Tape
- Scissors
- Paper clip

For the class you will need:

- Stopwatch
- Tape measure (either standard or metric)

**Safety Instructions:** Do not fly paper gliders directly at another person because the pointed tip could cause injury. Use caution when flying the paper airplanes. Create a single direction flight zone. Be sure that students stop flying their airplanes when other students are retrieving airplanes that have already landed.



## Procedure:

### A. Warm-up

Explain to the class the function of the rudder, ailerons and elevators.

### B. Activity

1. Cut out the three shapes from the pattern. Cut the slits in the wings and fin, but **do not fold them back**.
2. Fold the wing in half along the center dotted line. Fold each wing back along the second dotted lines. Tape the straw on top of the wing so that it sits on top of the folds. The folded section underneath the straw will assist in launching the glider.
3. Tape the tail to the end of the straw so that the end of the straw is lined up with the center of the tail.
4. Cut a slit at the top of the straw at the tail end. Insert the fin vertically into the slit and tape it into place.
5. Attach a paper clip to the nose.
6. Test the glider in a large, indoor area (such as a gymnasium). At one end of the gym, put a piece of masking tape on the floor to designate where the student will stand to launch the glider. For the first flight, leave the rudder, ailerons and elevator flat.
7. Measure and record how far the glider flew, the distance it flew, how straight it flew, and the length of time the glider was aloft. Record results on the Recording Sheet.
8. Now it is time to discover how the rudder, ailerons and elevator can affect the flight of the glider. First, students will predict what affect each change will have on the glider. Then, changing only one variable at a time, students will test fly the glider and record results.
9. Record results.

### Assessment/ Evaluation:

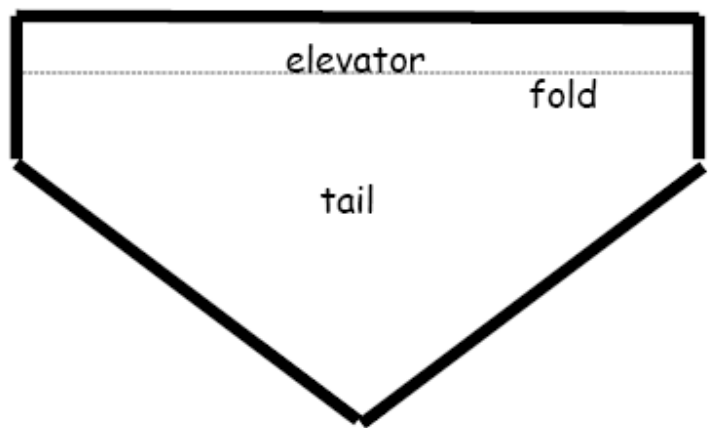
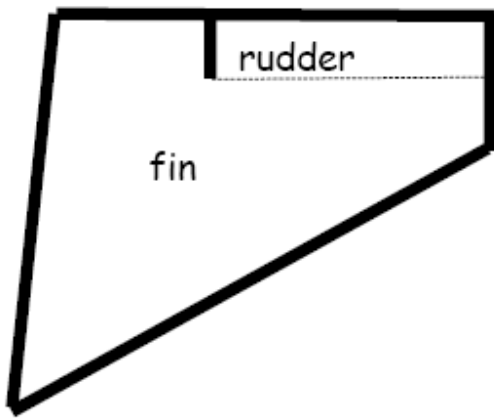
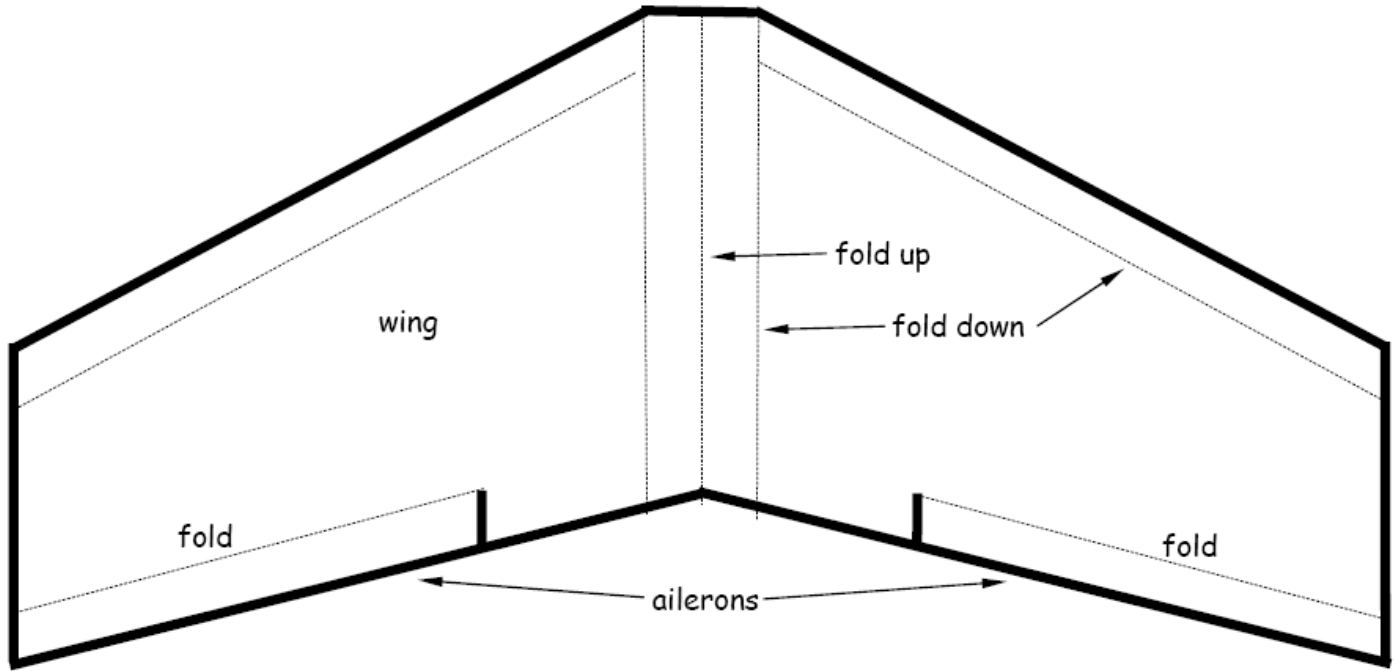
Students will write a paragraph explaining observations made during the various test flights.

### Extensions:

1. Create a graph comparing the results of the glider's time aloft when the elevators are flat as opposed to bent. Calculate a class average.
2. Write a creative story about a flight where the rudder, ailerons and elevators were frozen. What would happen?
3. Have a contest to determine which glider stays aloft the longest, flies the farthest or is the most accurate.
4. Put a master copy of the glider on the overhead projector and have students measure and draw their own pieces to be cut out.



# Controlling Flight: Rudders, Ailerons, and Elevators



|   | <b>Time Aloft</b> | <b>Distance Flown</b> | <b>Direction Of Flight: Straight, Right, Left</b> | <b>Observations</b> |
|---|-------------------|-----------------------|---|---------------------|
| <b>Rudder Folded Left</b>                     |                   |                       |   |                     |
| <b>Rudder Folded Right</b>                    |                   |                       |   |                     |
| <b>Elevator Folded Up</b>                     |                   |                       |   |                     |
| <b>Elevator Folded Down</b>                   |                   |                       |   |                     |
| <b>Ailerons Folded Up</b>                     |                   |                       |   |                     |
| <b>Ailerons Folded Down</b>                   |                   |                       |   |                     |
| <b>One Aileron Folded Up, One Folded Down</b> |                   |                       |   |                     |

