Flight School: The Great Paper Airplane Challenge

Materials Needed:

- Several sheets of standard printer paper (at least 10)
- A measuring tape or yardstick
- Paper clips (various sizes if possible)
- Scissors
- A pencil or pen for taking notes
- An open space for test flights (a long hallway, living room, or backyard)
- Optional: Crayons or markers for decorating
- Optional: A tablet or computer to watch a short video

Lesson Plan Details

Subject: Science (Aeronautics & Physics)

Grade Level: 3rd-4th Grade (Age 9)

Time Allotment: 60-75 minutes

Learning Objectives

By the end of this lesson, the student will be able to:

- **Identify and describe** the four forces of flight (lift, weight, thrust, drag) in their own words.
- **Apply** the scientific method by forming a hypothesis, testing it, and drawing a conclusion about their airplane's design.
- **Design and construct** at least three different paper airplanes, modifying each to test variables like wing shape, weight, and balance.
- **Measure and record** flight data (distance) to compare the performance of their different designs.

Lesson Activities (Step-by-Step)

1. The Spark: Introduction (10 minutes)

- **Engage:** Ask the question, "What makes something fly? Why doesn't a crumpled piece of paper fly like a paper airplane?" Discuss initial ideas.
- **Introduce the Concept:** Explain that all flying things—from tiny insects to giant jets—are affected by four invisible forces. These are **Lift, Weight, Thrust, and Drag**.
- **Visual Aid:** Watch a short, simple video explaining the four forces of flight. A great option is "The Four Forces of Flight" by SciShow Kids on YouTube.
    - **Lift:** The upward force that pushes the plane up. (Created by the wings).
    - **Weight:** The downward force of gravity pulling the plane down.
    - **Thrust:** The forward force that moves the plane ahead. (For a paper airplane, this comes from your throw!).
    - **Drag:** The backward force of air resistance that slows the plane down.

2. The Blueprint: Design & Hypothesis (20 minutes)

- **Build Model #1 (The Control):** First, build a basic, classic paper airplane together. This will be your "control" model—the one you compare everything else to. (A simple "Dart" design is perfect).
- **Brainstorm Modifications:** Ask the student: "How could we change this plane to make it fly farther, or maybe do a trick? What if we made the wings wider? What if we added weight to the front?"
- **Form a Hypothesis:** Have the student choose one variable to change for their next plane. They should make a prediction.
  *Example Hypothesis: "**If I** add a paperclip to the nose of my plane, **then it will** fly straighter and farther **because** the extra weight will balance it."*
- **Build Model #2 & #3:** The student should now design and build two more airplanes. Encourage creativity!
  - One plane should be their "hypothesis" plane, with just one specific change from the control model.
  - The other can be a completely new, creative design. Maybe it has rounded wings, or cut flaps on the back. Let them experiment!
  - This is a great time to decorate the planes with markers.

3. The Launch: Test Flights & Data Collection (20 minutes)

- **Set up the Runway:** Lay the measuring tape on the floor to create a test flight zone. Mark a clear "launch line."
- **Test & Measure:** The student will test each of the three airplanes. For a fair test, they should:
  1. Throw each plane three times from the launch line.
  2. Try to use the same amount of thrust (throwing force) each time.
  3. Measure the distance of the best flight for each plane.
- **Record the Data:** Use a piece of paper to create a simple "Flight Log." Make three columns: "Plane Design" (or draw a picture), "Hypothesis/Modification," and "Best Distance."

4. The Debrief: Reflection & Conclusion (10 minutes)

- **Analyze the Results:** Look at the Flight Log together. Ask questions to encourage critical thinking:
  - "Which plane flew the farthest? Why do you think it did?"
  - "Was your hypothesis correct? How did the paperclip change the flight?"
  - "Which design had the most drag? How do you know?"
  - "How did changing the wing shape affect the plane's lift?"
- **Connect to the Concepts:** Help the student connect their observations back to the four forces. For example: "When you added the paperclip, you increased its **weight** at the front, which helped it overcome **drag** and fly straighter."

Differentiation & Extension

- **For Extra Support:** Provide pre-printed templates for 3-4 different airplane designs. Focus the discussion on just two forces, like lift and weight, to keep it simple.
- **For an Extra Challenge (Advanced Aeronautics):**
  - **Ailerons and Elevators:** Challenge the student to cut small, foldable flaps on the back edges of the wings. How does bending them up or down change the flight path? (This introduces control surfaces).
  - **Center of Gravity:** Experiment with placing paperclips in different spots (wings, tail, nose) to find the plane's perfect balance point, or center of gravity.
  - **The "Stunt Plane" Challenge:** Can you design a plane that is meant to do a loop-the-

loop instead of flying straight? What design features would help it do that?

Assessment

Understanding will be assessed through observation and discussion, not a formal test. Look for:

- **Verbal Explanation:** Can the student explain why their best plane worked well, using at least one of the four forces (e.g., "It had wide wings so it had good lift," or "It was sleek, so it had less drag").
- **Scientific Process:** Did the student successfully create a hypothesis, test it, and talk about the results?
- **Flight Log:** The completed Flight Log serves as a record of their experimentation and data collection.