Hoop Gliders

Grade Level: K-3rd grade

Duration: 20-30 minutes; or 5 minutes at a Science Fair

Classification: Classroom, Science Fair, STEM Spark

Subject(s): Physics, Engineering

Categories (STEM): Engineering, Science

Keywords: Physics, Flight, Drag, Lift, Gliders, Aerospace

Introduction

- Summary: Students understand and can explain the four forces of flight that allow airplanes to fly.
- Description:
    - Students learn what are the four forces of flight (See Background doc for info).
    - Students build a hoop glider out of straws and index cards.
    - Students discuss how the four forces of flight are working to make their hoop glider fly.

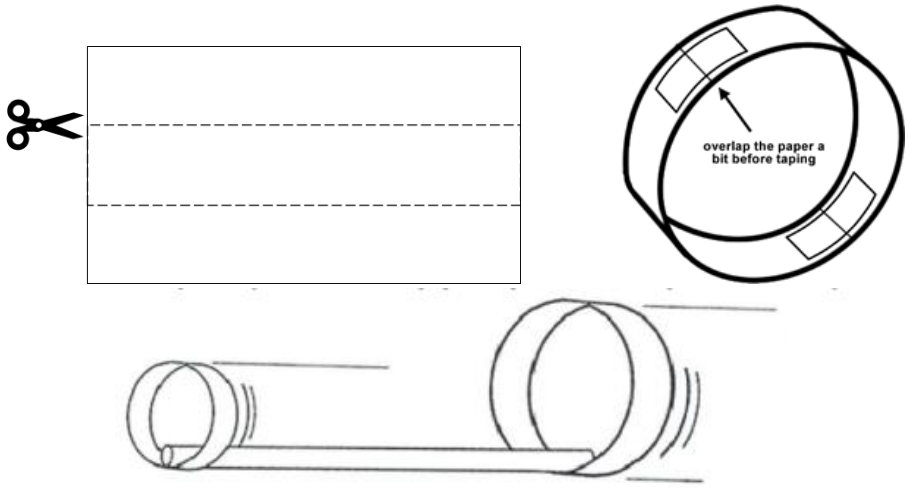
Online Resource:
https://www.masd.k12.wi.us/faculty/schrere/Extra%20Credit%20Lab%20Incredible%20Hoop%20Glider.pdf

Materials

Material	Quantity	Reusable?
Non-bendable Plastic straw	1 per student	No
3x5 index cards	1 per student	No
Clear Tape	2 rolls	No
Scissors	1 per 4 students	Yes
Pencils/Pens	2	Yes
Copy paper (Activity Extension)	20-30pages	No

Directions

- Cut the index card lengthwise to create 3 equally sized pieces that are roughly 1" by 5"
- Tape two of the strips together end-to-end, then use the longer strip to make a large circle. **Make sure to overlap the ends** about half an inch so they keep their rounded shape!
- Create a smaller circle using the last strip of paper, overlapping the edges like before.
- Tape the paper loops to the end of the straw with the straw inside the hoops. Try to avoid placing the straw where the loops are taped together.
- Have students hold the straw in the middle with the hoops pointing upright and gently throw it with an upward angle.
- Experiment with how far they can throw their hoop glider.



Activity Extensions

- Add additional loops onto the glider to compare how it glides
- Construct a paper airplane and compare it to the flight of the hoop glider (use copy paper)
- Draw or write names on their hoops
- Air in Motion (Bernoulli Principle)
    - See Air in Motion document attached

Discussion Questions

- Does the placement of the hoops on the straw affect its flight distance?
- Is it better to fly the big hoop in front or the small hoop?
- Does the length of the straw affect the flight?
- Do more hoops help the glider fly better?
- Do the hoops have to be lined up vertically in order for the plane to fly well?
- Why does this plane design work? How does it use the four forces of flight?
- Would the glider sustain flight longer or shorter if a pencil was used instead of a straw?

What is happening?

- The two sizes of the hoop help keep the straw balanced as it flies
- The big hoop creates "drag" while the smaller hoop keeps the glider from turning off course
- Objects of different weight generally fall at the same speed, therefore the hoop keeps an upright position
- The hoops generate lift, sustaining the hoop glider in the air longer

Applications

- Majors
  - Aerospace Engineering: building and developing aircrafts
  - Physics: studying how forces act on objects at rest and in motion
- Jobs
  - Aerospace Engineering (Boeing, Nasa, Collins Aerospace, etc)
  - Physicist (academia, research)
- Hobbies
  - Kite flying
  - Model airplanes
  - Hobby drones
  - Parachutes and Gliders (both sustained by air lift)
  - Wind Tunnels
- Real world applications
  - Airplane wings are curved to create difference in air pressure (aka, **lift**)
  - Airplanes, space shuttles, racecars, high-speed trains all try to minimize their front surface area to decrease their **drag**.
  - Airplane wings get extended upward upon landing to increase the amount of drag slowing a plane.