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RESOURCE AREA FOR TEACHING

STEAM
SCIENCE TECHNOLOGY ENGINEERING ARTS MATHEMATICS

LEARNING ACTIVITY

Paper in Flight – Level 1

Drop it! Aerodynamics for Beginners

Gliders can teach us a lot about aerodynamics. The Wright brothers built, and tested, over 200 unpowered gliders before they flew a self-powered airplane.

Activity Challenge
Create a paper glider that will go where it's aimed.

Preparation

1. Select a workspace suitable for dropping and tossing paper.
2. Collect sheets of paper of different thicknesses and types.
3. Letter size paper can be cut, or torn, into quarter sections to provide more material for experimentation.

To Do

1. Create a data table, like the one on the next page, using the same headings (shape of paper, fall time, etc.).
2. Select, then cut, or tear, several sheets of paper to be of equal size.
3. Crumple one of the sheets into a tight ball.
4. Hold the tight ball, and an uncrumpled sheet of paper, at the same height above your head.
5. Drop both simultaneously. Note in the table which piece of paper hits the floor first. Describe, or draw, how each moved as it fell.
6. Create a cone shape from a sheet of paper. To secure the cone shape use tape, glue or a paperclip.
7. Drop the cone with its small end pointed downward, and again with the small end pointing up. In the table, describe, or draw, the motion of the cone, as it fell, for both orientations.
8. Repeat with the cone held at different angles. In the table, describe, or draw, the differences observed.
9. Drop a plain sheet, and then a cone with the point downward Describe, or draw, in the table how each move as they fall.

Observations

- How do differently shaped objects move as they fall?
- Which direction will the cone shaped paper point as it hits the floor?
- Compared to a crumpled sheet of paper, the flat sheet likely moved side to side as it fell and took a longer time to fall.
- From the notes or drawings in the table, describe in more detail the differences and reasons, for the things that were observed doing these experiments.

Materials Needed

- Paper of various thicknesses and types
- Optional: Paperclips, staples, glue, or tape, might be needed

Grade Range
3-5
6-8

Topics/Skills
Aerodynamics
Science
Engineering

Learning Standards
NGSS: Motion and Stability: Forces and Interactions

Duration
15 minutes

Prep Time
5 minutes

Extensions

- Imagine that you were going to make your plane on a larger scale. What types of materials would you need and how would the project come together?

The Science behind the Activity

To go faster, bike riders and skiers bend over instead of staying in an upright position. They do this to reduce the amount of resistance, or **drag**, that their bodies present to the air. Less drag allows them to move faster through the air. Finding ways to reduce drag is very important in airplane and automobile design.

The ability to stay in a set position, called **stability**, is another factor for successful flight. The cone shape is more stable than a flat sheet of paper as it falls. The cone shape always turns to fall point downward, which is the most stable position for the cone.

When a horizontal flat sheet of paper is dropped, air currents will cause the paper to tilt. The leading edge will experience a slight drag from the air. Paper can flex and bend slightly. As the paper surface tilts away from being perfectly upright (vertical), more of the surface becomes angled downward. The air's resistance to the paper's movement increases as more of the sheet's area faces downward. The increasing resistance will increase the paper's sideways movement so the sheet "flies" away from falling straight down. The flat sheet's longer flight path means the cone shape will most often hit the floor before the flat sheet.

Sample Data Table

Shape of paper	Time to reach floor	Flight path	Notes
Crumpled			
Flat			
Cone point up			
Cone point down			