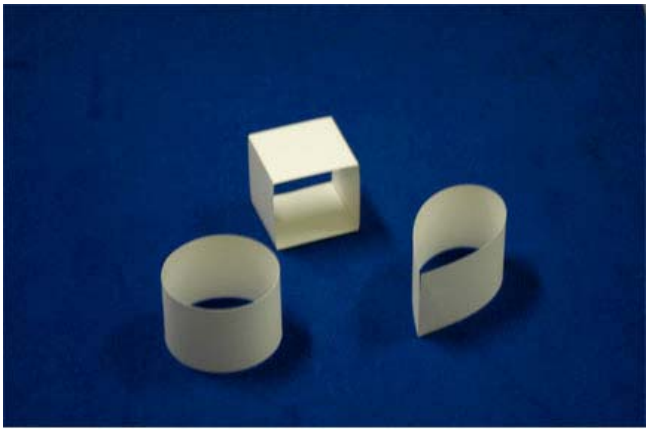
PARACHUTES

Lesson Plan: Does Shape Affect Drag?



Grade Level: 6-7

Subject Area: Science and Math

Time Required: ***Preparation:*** 1 hour
Activity: 3-4 class periods

National Standards Correlation:

Science (grades 5-8)

- Science as Inquiry Standard: Understanding about scientific inquiry.
- History and Nature of Science: Nature of science.
- Physical Science Standard: Motion and forces.
- Unifying Concepts and Processes Standard: Evidence, models, and explanation.

Math (grades 6- 8)

- Measurement Standard: Apply appropriate techniques, tools, and formulas to determine measurements.
- Data Analysis and Probability Standard: Select and use appropriate statistical methods to analyze data.

Summary: Students will learn about drag and how it affects a parachute in the sky. The students will begin by exploring the drag of a similar pattern parachute and a fixed weight. Students will then design three different-shaped parachutes with a fixed weight and test their drag. They will complete 3 trials for each, chart the time of descent for each, compute average descent time, and graph the results.

Objectives: Students will:

- Build a variety of models to compare drag
- Show an understanding of drag and why it is important to a parachutist
- Measure time, average results, chart and graph the results

Background: The four forces acting upon airborne objects are lift, gravity, thrust, and drag. This lesson focuses on the force of drag. Air resistance, or drag, is the force at work that pushes against things and causes them to slow down. A parachutist relies on drag to slow him/her down as they descend to the earth.

Materials: For Warm-up:

- Paper napkins
- 4 pieces of kite string- 18” each
- Large paper clip
- Reinforcement labels or adhesive dots
- 3 pieces of paper (6 cm wide by 30 cm long)

Originally published as part of *Project SOAR™: Science in Ohio through Aerospace Resources, Volume I-III.* Dayton, Ohio: The National Museum of the United States Air Force and The Air Force Museum Foundation, Inc. 1997-1999.

For Activity:

- 3 pieces of nylon (24 cm square)
- String
- Reinforcement labels or adhesive dots
- Washers
- Scissors
- Stopwatches

Procedure:

A. Warm-up

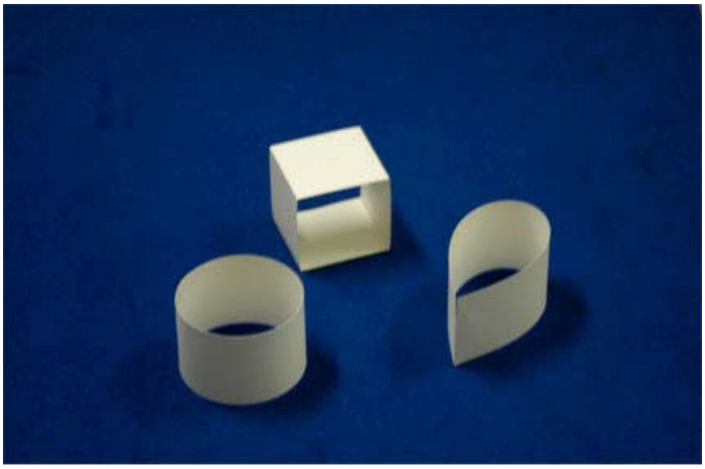
1. Introduce the term drag and ask what it means.
   Ask:
   - What effect does it have on an airborne object?
   - What are some objects that are affected by drag?
   - How could we demonstrate drag?

2. Cut three strips of paper (6cm wide by 30cm long) from notebook paper. Form and tape the strips into these shapes: a circle, a square, and a teardrop.

3. Ask students to predict: Which will have the most drag? Which shape will have the least drag?

4. Drop each shape with arm outstretched overhead and time how long it takes to reach the ground. (See shapes in Figure 1.)

Figure 1



5. Conduct three trials for each.

6. Ask:
   - Which shape has the most drag? Why? (Some objects catch air easily, which causes more drag.)
   - Which shape has the least drag? Why? (Some objects have shapes which allow air to move around them easily, causing less drag.)

7. Have students further test drag by creating a parachute out of a paper napkin.

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8. Then have students cut 4 pieces of string, 18 cm long. Direct them to attach the string to each corner of the napkin with adhesive dots and tie the free ends to a paper clip. Note: Make sure the strings are of equal length when fastening to the paper clip.

9. Ask students to drop their parachutes from a predetermined height and observe the rate of fall.

10. Ask: How can we change/improve the amount of drag on a parachute? Shape?

B. Activity

1. Have students discuss, design and cut 3 different shapes from nylon (3 pieces 24 cm square).

2. Fasten string (the same length for all parachutes) to each corner using reinforcement labels or adhesive dots.

3. Attach the free ends of string to a washer.

4. After students have completed their construction, prepare an area to test the falling parachutes.

5. Have students test each parachute by conducting 3 trials with each one. (Make sure all parachutes are dropped from the same height.)

6. Record the results of each on a chart.

7. Average the trials and also record on the chart.

8. Have students prepare a line graph showing the results.

C. Wrap-up

1. Ask students to compare results in their assigned groups.

2. Then have the slowest descending parachutes in each group compete against each other to find the slowest in the class.

3. Ask: What factors may have affected some parachutes falling slower than others? (Shape of parachutes and design flaws should impact the times).

Assessment/ Evaluation:

Students should be assessed on classroom participation and accuracy of data collected and recorded.

Extensions:

1. Make parachutes from different materials.

2. Use more/less weight on each of the parachutes.

Resources/ References:

A World in Motion. SAE International. Warrendale, PA: The Mazer Corporation, 1990

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