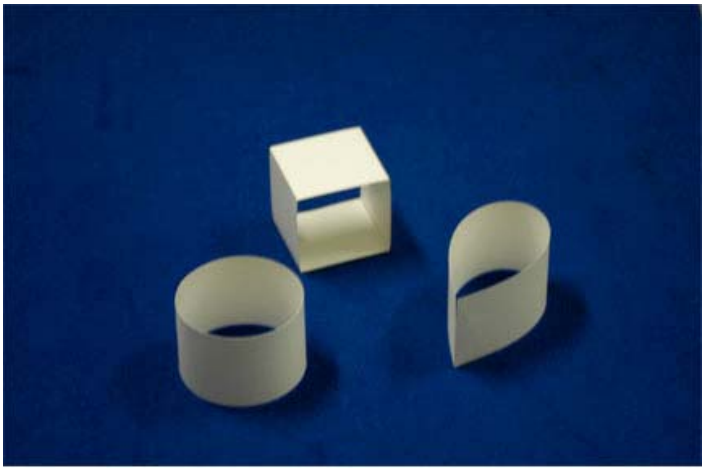
PARACHUTES

Lesson Plan: What a Drag



Grade Level: 5-6

Subject Area: Science and Math

Time Require: ***Preparation:*** 1 hour
Activity: 3-4 hours

National Standards Correlation:

Science (grades 5-8)

- Physical Science Standard: Motion and forces.
- Unifying Concepts and Processes Standard: Evidence, models, and explanation.
- Unifying Concepts and Processes Standard: Change, constancy, and measurement.
- Physical Science Standard: Motions and forces.

Math (grades 3-5)

- Data Analysis and Probability Standard: Understand and apply basic concepts of probability.

Math (grades 6-8)

- Data Analysis and Probability Standard: Understand and apply basic concepts of probability.

Summary:

Students will discover how the force of drag affects a parachute. Students will make two different parachutes and measure their time of descent. The culminating activity is to design two different parachutes and test to see which has the most drag. Students will graph the time of descent for each parachute, compute the average descent time, and compare their results with classmates on a class graph.

Objectives:

Students will:

- Demonstrate an understanding of drag and how drag can be applied to everyday situations
- Build a variety of models to compare drag
- Measure time, average results, and plot data results on a line graph

Background:

Aerodynamics is the study of the forces acting upon objects as they move through the air. The four principal forces acting upon airborne objects are lift, gravity, thrust, and drag. This lesson focuses on drag. Drag, or air resistance, is the force of the air pushing against things and causing them to slow down or stop. It is the opposite of thrust. Air resistance helps the parachutist, ski jumper and flying squirrel by slowing them down as they move through the air.

Materials:

For warm-up:

- Large sheet of heavy poster board
- Stopwatch or clock with a secondhand
- Umbrella
- 2 manila folders per group or students

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- Scissors
- Tape

Materials for activity:

- Plastic garbage bag (cut 4 squares, 25 cm per side)
- String
- Washers - 4 each
- Reinforcement labels or small stickers or tape
- Scissors
- Stopwatch

Safety Instruction: Choose a clear area for the activity. Discuss appropriate behavior to use when testing parachutes.

Procedure:

A. Warm-up

To introduce students to the concept of drag, complete part or all of the following activities. Ask what the word drag means and what it means in relationship to an airborne object. How do you think we could demonstrate drag? Use students' ideas as well as the following activities:

1. Have a student run between two points. Run again, but this time, the runner will hold a large sheet of poster board in front of him/her. Repeat with the edge against the wind. Observe and discuss differences in the amount of resistance. Time the three runs with a stopwatch. Discuss differences.

2. Give a student a closed umbrella. Have him/her hold the umbrella behind him and run. Discuss the amount of air resistance or drag on the umbrella. Now open the umbrella, have the student hold it behind them, and run. How has the amount of drag changed? Why has it changed?

3. Take two identical sheets of paper in your hands - one flat, one crumpled. Hold your hands at the same height. Predict which paper will reach the ground first. Drop the two papers at the same time. Observe. Which one reached the ground first? Why? (Crumpled paper has less air resistance, or drag).

4. Cut three strips of paper (6 cm wide and 30 cm long) from manila folders. Form and tape these strips into a circle, a square, and a teardrop shape. Bottom edges should be smooth.

    a. Put the three shapes about 10 cm from the edge of a table. Predict: Which shape has the most drag? Which shape has the least drag? With your mouth at the level of the table, blow air directly at each shape. Blow with the same force at each individual shape. Which shape was most easily pushed back?

    b. Try again, blowing harder. Which shape has the most drag? Why? (Some objects have shapes that catch air easily, which causes more drag. The more drag an object has the more easily it can be pushed back). Which shape has the least drag? Why? (Some objects have shapes that allow air to move around them easily causing very little drag). What do we call objects that allow air to flow around them easily? (streamlined) Which shape is the most streamlined? How do you know? (teardrop) Can you think of a more streamlined shape than a teardrop? Develop one. Experiment with your model.

B. Activity

1. Cut 4 squares from a plastic garbage bag, each having sides 25 cm long.

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2. Cut 4 pieces of string, each the same length. (The string measurement should be the same for all parachutes so that the only variable is the shape of the parachute).

3. Attach the pieces of string to the 4 corners of the plastic square using sticky circles.

4. Gather up the other ends of the 4 strings and attach to a washer.

5. Next, make a circular parachute from another plastic square. Cut it out.

6. Cut 6 pieces of string, each the same length as the other strings.

7. Attach the pieces of string, to 6 evenly spaced places on the plastic circle using the sticky circles.

8. Test the falling speed of each parachute. Predict: Which parachute creates the most drag? Drop each parachute. Work with a partner to time how long it takes for the washer to hit the ground. Do 3 trial runs.

9. Develop a record sheet. Record results. Find the average. Record. Graph the results on a line graph.

C. Wrap-up

1. Using two additional squares, design two more shapes for a parachute and test them.

2. Plot the results on your individual line graph.

3. Choose the slowest falling parachute and record the time of descent on a class graph to compare with other students.

Assessment/ Evaluation:

Students should be evaluated on the accuracy of data recorded.

Extensions:

1. Put a hole in the top center of the parachute. What will happen?

2. Make parachutes of different sizes.

3. Make parachutes of different materials.

4. Put two parachutes together and test.

Resources/ References:

A World in Motion. Developed for SAE International. Warrendale, Pennsylvania: The Mazer Corporation, 1990.

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