THE OPTION DERBY INVESTIGATION

A Word About Our Special Guests

Viewers will be introduced to the mysterious racing team, known as Team N (the N stands for Newton), through video clips shown throughout the show. Members of this team are actually middle school students from Newport News, Virginia, and are CHROME club members in their school. CHROME is a nonprofit organization whose mission is to increase the number of minorities and females entering engineering, science, math, and related career fields. Programs sponsored by CHROME include clubs in the elementary, middle and intermediate, and high schools. Information about CHROME is available at https://www.chrome.org/.

Program Activities and Enrichment

Viewers are encouraged to participate in the experiments conducted by the science sleuths during the broadcast. Listed below are the program experiments and additional experiments for each physics concept. The additional experiments may be completed either before or after the broadcast as introductory or reinforcing activities.

Educators are encouraged to continue the science sleuth investigation with their students through the implementation of a class option derby. Option derby learning cards are in Section 2: Program Follow-up of these materials. The option derby is extracted from the educational program "A World in Motion", developed for elementary students by the Society of Automotive Engineers. Information about "A World in Motion" is available at https://www.sae.org/learn/education.

SECTION 1: ACTIVITIES

Program Experiment: Inertia

(Team N, Mr. Vranas, and Shelley Canright will conduct a demonstration of inertia during the broadcast. No materials are needed.)

Additional Inertia Experiment: In a Spin

Try to stop a spinning egg. It's not as easy as you might think. Once an object is moving, inertia makes it more difficult to stop the object.

You will need: a fresh egg and a large bowl

To test:

1. Place the egg in the bowl. Spin the egg.

2. Gently grasp the egg with your fingertips to stop the spinning.

3. Quickly let the egg go. It starts to spin again. (Reason: When you spin the egg, the liquid inside it starts to move, too. It's hard to make the liquid stop moving. Inertia keeps it going and starts the egg turning again.)

Program Experiment: Friction Slope

Investigate friction created by different surfaces with an adjustable slope.

You will need: cardboard scale; pen; protractor; ruler; knife; wooden block; screwdriver; thumbtacks; hinge and screws; two pieces of balsa or plywood; and test surface samples (coarse sandpaper, aluminum, wax paper, rubber)

To build the friction slope:

1. Screw the two pieces of wood to the hinge to make the adjustable slope. Alternatively, make your own hinge by gluing the wood to a short strip of strong fabric.

2. With the protractor draw a scale of angles on the card. Fix this to the base at the hinge with thumbtacks. Set up the slope on a table for the tests.

To test the different surfaces:

1. Put the block on the slope. Tilt the slope until the block just starts to slide. Note the angle. Record the surface type (wood) and the angle at which the block begins to move.

2. Now try the test with different surfaces. Cut test surface samples to fit the dimensions of the length and width of the slope. At what angle does the block start to move on these? Record results.

Extension: Try different lubricants, such as oil, water, and talcum powder. Retest the surfaces. What differences are observed? Is one lubricant better than another? Does one lubricant work best for one surface while another lubricant works best for a different surface?

Additional Friction Experiment: On the Slide

Make a slide to test for friction and to see how some objects move more easily than others. This is because their surfaces create different amounts of friction with the surface of the slide.

You will need: pumice; small glass bottle with flat sides; eraser; wooden block; and smooth wooden board (such as a cutting board)

To test:

1. Put the objects in a line at one end of the board. Very slowly tilt the board up.

2. Keep tilting the board. The objects begin to move, one at a time.

3. Record the order in which the objects start to move. Which object is the last to move? Which object creates the greatest friction between its surface and the wooden board?

Program Experiment: Streamlining

To keep drag (friction with the air) to a minimum, aircraft, fast cars, and even birds are specially shaped or "streamlined." The aim is to get air to flow around them as smoothly as possible, because the more the air is churned up, the greater the drag.

You will need: posterboard (30 cm x 45 cm); 4 or 5 books; small toy car; meterstick; paper fan; construction paper; scissors; and tape

To test:

1. Use the posterboard and books to make a ramp 5 cm high on the floor. Use tape to mark a start line at the top of the ramp. Set the toy car on the tape, using a ruler for a starting gate. Lift the ruler to start the car. Mark where the car stopped.

2. Ask a teammate to sit at the mark from step 1. Repeat step 1 while your teammate waves a fan side to side at the car as it rolls. Mark and measure in centimeters how far the car rolled from the bottom of the ramp. Record the results.

3. Cut out a construction-paper shield 5 cm square. Tape the bottom edge of the shield to the front of the car as shown. Repeat step 2. Did the car roll as far as it did without the shield in step 2?

Extension: Find a way to attach the shield to the car so that the car moves the same distance it did when you fanned it without the shield.

Additional Streamlining Experiment

You will need: candle; saucer; modeling clay; cardboard; and paper clips

To test:

1. Hold the cardboard flat in front of a lighted candle. Blow toward the candle. Notice the reaction of the flame. (The flame gutters toward the cardboard. This is because the air stream curls and eddies around the card. The drag on a shape that disturbed the air this much would be considerable.)

2. Bend the cardboard into a teardrop shape, clip it together, and line it up in front of the candle. Again, blow toward the candle. How does the candle flame react this time? (The flame will bend over smoothly, showing that the cardboard has upset the air stream very little. This is a streamlined shape.)

Program Experiment: Loads and Balance

The point on an object at which the object can be balanced is its center of gravity. Adding mass to an object can change its center of gravity.

You will need: 5 or6 books; empty, clear, 16-ozcarbonated beverage bottle with lid; clay (size of table-tennis ball); posterboard (30 cm x 45 cm); meterstick; and masking tape

To test:

1. Make a record sheet with three columns-Bottle Description, Movement Description, and Distance Traveled.
2. Use books and the posterboard to make a ramp 15 cm high. Place the bottle on its side atthe top of the ramp. Let the bottle roll down the ramp. Did the bottle roll straight? Describe its movement in the Movement Description column of your record sheet. Measure in centimeters how far the bottle traveled. Record your answer in the Distance Traveled column.
3. Roll the clay to form a stick about 1 O cm long. Put the clay stick inside the bottle. Repeat step 2. How did the bottle move down the ramp? Did the bottle travel as far as it did in step 2? Record the results. Remove the clay.
4. Roll the clay into a ball. Stick the clay ball inside the lid. Replace the lid. Repeat Step 2. How did the bottle move this time? How far did the bottle travel?
5. Tape the clay ball to the bottom of the bottle. Repeat step 2. How did the bottle move? How far did it travel?

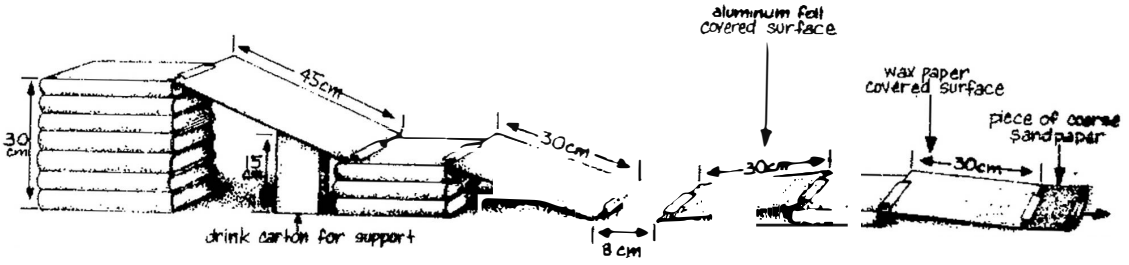
Extension: How far can you make the bottle roll with its load of clay? Shape the clay any way you wish, but keep it in one piece. Measure in centimeters and record how far the bottle rolled.

SECTION 2: PROGRAM FOLLOWUP

Classroom Option Derby

Educators and students are encouraged to conduct a classroom option derby. Following are the race course design, materials needed, and five learning cards from "A World in Motion" that can be reproduced and used to establish a derby.

Classroom Derby Racecourse materials: 1 posterboard (30 cm x 45 cm); 3 posterboards (30cm square); 15-20 books; masking tape; aluminum foil; coarse sandpaper; 2 metersticks; ½-gallon drink carton; and wax paper



Wheels and Axles materials: pint-sized carton; meterstick; pushpins; stir straws; 4 platforms from push-up ice cream (wheels); posterboard (30 cm x 45 cm); masking tape; large straws; scissors; 6 hardcover books

Friction materials: hardcover books; meterstick; 1 posterboard (30 cm x 45 cm); 2 posterboards (30 cm square); aluminum foil (30 cm long); rubber bands; masking tape; sandpaper; cotton swabs; talcum powder; cooking oil; team racer

Streamlining materials: posterboard (30 cm x 45 cm); hardcover books; small toy car; meterstick; scissors; paper fan; construction paper;tape; team racer

Loads and Balance materials: hardcover books; meterstick; 3 heavy washers; masking tape; 1 posterboard (30 cm x 45 cm); 2 posterboards (30 cm square)

Balloon Power materials: 2 balloons (1 long, 1 round); posterboard (30 cm x 45 cm); tape; pushpin; meterstick; paper clip; index card; hardcover books; pencil; team racer