

The Friction Grand Prix

Overview: Friction is defined as surface resistance to relative motion. Sounds exciting, huh? Well, it can be very exciting if we grab some toys and ~~play~~ conduct this hand-on experiment.

Procedure:

- 1) Give students the following writing prompt: *What can change how far a Matchbox car will roll?* After students have written their responses, encourage them to share their ideas with the class.
- 2) Present students with the activity materials. Ask each student to choose a Matchbox car. Show students the various ramp surfaces that will be used (see Materials Needed section below).
- 3) Given two or more ramp surfaces, ask students to predict/hypothesize which will allow the car to travel the furthest.
- 4) Students should take turns releasing cars at the top of the ramp from a stand still. Once a car travels down the ramp, it will continue to roll across a long table or the floor. Using a measuring tape or yard stick, students will need to measure the distance (in inches) between the end of the ramp and the front of the car. Students should record the data. Conduct multiple trials for each ramp surface.
- 5) As a class, look at the data. Ask students to determine which ramp surface allowed the cars to travel the furthest? Rank the surfaces in order of distance yielded. Encourage students to ask questions or give thoughts about the results. Each student should check to see if his/her hypothesis from step 3 was correct.
- 6) Introduce the concept of friction to your class. [Here is a simple article](#) that explains friction.
- 7) As a class, brainstorm other factors that may affect how far the cars can roll. Can any of these ideas lead to future experiments and lessons?

ASOLs Covered in this Activity:

SCIENCE

5S-FME 1c: The student will investigate and understand characteristics and interactions of moving objects. Key concepts include friction is a force that opposes motion.

Extension Idea:

This activity illustrates the effect that friction has on motion. The various ramp surfaces should impact how far the cars will roll. Once the experiment is finished, it is important to define “friction” and explain its effect. Can you and your students identify other examples of friction opposing motion?

- 5S-SI 1:** The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which
- a) distinctions are made among observations, conclusions, inferences, and predictions;
 - b) objects or events are classified and arranged according to characteristics or properties;
 - c) appropriate instruments are selected and used to measure length, mass, volume, and temperature in metric units;
 - e) predictions and inferences are made, and conclusions are drawn based on data from a variety of sources;
 - f) independent and dependent variables are identified;
 - g) constants in an experimental situation are identified;
 - h) hypotheses are developed as cause and effect relationships;
 - i) data are collected, recorded, analyzed, and displayed using bar and basic line graphs;
 - k) data are communicated with simple graphs, pictures, written statements, and numbers;
- 5S-SI 2** The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which
- b) estimates are made and accurate measurements of length, mass, volume, and temperature are made in metric units using proper tools;
 - d) hypotheses are formed from testable questions;
 - e) independent and dependent variables are identified;
 - f) constants in an experimental situation are identified;
 - g) data are collected, recorded, analyzed, and communicated using proper graphical representations and metric measurements;
 - h) predictions are made using patterns from data collected, and simple graphical data are generated;
 - i) inferences are made and conclusions are drawn;
- 8S-SI 1** The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations which
- a) observations are made involving fine discrimination between similar objects and organisms;
 - b) precise and approximate measurements are recorded;
 - e) a method is devised to test the validity of predictions and inferences;
 - f) one variable is manipulated over time, using many repeated trials;
 - g) data are collected, recorded, analyzed, and reported using metric measurements and tools;
 - h) data are analyzed and communicated through graphical representation;
- HSS-SI 1** The student will plan and conduct investigations in which
- c) scales, diagrams, charts, graphs, tables, imagery, models, and profiles are constructed and interpreted;

e) variables are manipulated with repeated trials.

HSS-SI 2 The student will demonstrate an understanding of the nature of science and scientific reasoning and logic. Key concepts include

b) evidence is required to evaluate hypotheses and explanations;

c) observation and logic are essential for reaching a conclusion

Extension Idea:

These standards can be addressed through the course of this activity's scientific process.

READING & WRITING

3E-RW 2a: The student will use newly acquired vocabulary drawn from reading and other content areas.

3E-CN 1g: The student will sequence at least two steps in a procedure or ideas/incidents in an event.

4E-RW 1c: The student will use newly acquired vocabulary drawn from reading and other content areas.

5E-RW 1f: The student will demonstrate understanding of content-specific words.

7E-RW 1e: The student will demonstrate an understanding of word relationships by using synonyms and antonyms.

7E-CN 1e: The student will use content words and phrases from a nonfiction text.

8E-RW 1e: The student will acquire and use content words and phrases.

8E-WP 1a: The student will write to convey ideas and information including facts, details, and other information.

b: The students will write about a personal experience by introducing the event or experience, at least one character, and two or more events in sequence.

d: The student will use content specific vocabulary when writing about a topic.

8E-WP 3b: The student will write to convey ideas and information including facts, details, and other information as well as graphics and multimedia as needed.

8E-WP 5a: The student will write an argument to support a claim with one clear reason or piece of evidence.

HSE-WP 1b: The student will write to convey ideas and information using clear organization and including facts, details, and other information as well as graphics and multimedia as needed.

c: The student will write about an event or personal experience by introducing the event or experience, at least one character, and describing multiple events in sequence.

HSE-RW 2c: The student will acquire and use content words and phrases.

Extension Idea:

Upon completion of this experiment, students will write a text that summarizes their experiences and findings. This can be a fun way for the students to demonstrate what they have learned. Particular attention may be given to content words, figurative language, and sequence of events. Encourage students to include illustrations, tables, graphs, and digital photographs. Texts might take the form of a PowerPoint presentation, book, journal entry, newsletter, or blog. These texts might make great additions to self-selected reading libraries.

MATH

3M-PSPFA 1b: The student will use picture or bar graphs to answer questions.

c: The student will insert data into a pre-constructed bar graph template.

d: The student will interpret data from a variety of graphs to answer questions.

5M-PSPFA 1a: The student will compare two sets of data within a single data display such as a picture graph, line plot, or bar graph.

6M-PSPFA 1a: The student will display data on a graph or table that shows variability in the data.

b: The student will summarize data distributions on a graph or table.

c: The student will answer a question related to the collected data from an experiment, given a model of data, or from data collected by the student.

8M-PSPFA 1b: The student will describe how a graph represents a relationship between two quantities.

HSM-FS 2a: The student will indicate general trends on a graph or chart.

HSM-FS 3a: The student will, given data, construct a simple graph and answer questions about the data.

Extension Idea:

Students will use data to create a bar graph that displays distance (in inches or feet) that their car rolled beyond each ramp type. Ask students to interpret the data on the graph and confirm or edit their original hypothesis.

3M-MG 2a: The student will order by length using non-standard units.

Extension Idea:

This is an alternative to measuring the distance travelled by each car in inches or feet. After each car rolls across the table or floor, use a roll of masking tape to mark the distance from the end of the ramp to where the car stopped. Ask students to label the length of tape and this can be used to compare the lengths of each roll. The tape lengths can be used directly in a large bar graph.

4M-NSCE 1b: The student will compare whole numbers.

Extension Idea:

When rank interpreting the measurement data, students can rank the trials of each ramp surface by determining which distance is longest, shortest, etc.

4M-MG 1a: The student will identify smaller units that divide a larger unit within a measurement system.

Extension Idea:

Use this lesson as an opportunity to teach that there are 12 inches in a foot.

8M-MG 1a: The student will compare measures of angles to a right angle (greater than, less than, equal to).

HSM-EI 3b: The student will interpret rate of change (e.g., higher/lower, faster/slower).

Extension Idea:

A follow-up experiment may include altering the angle of each ramp. This provides a great opportunity to teach about angle measurement and how the angle of the ramp affects the speed and distance of the cars.

Materials Needed:

- toy cars (Matchbox, Hot Wheels, etc.)
- ramps with various surfaces such as cardboard, carpet, sandpaper, towel, etc.
 - **all ramps should be the same length
- measuring tape or yardstick
- masking tape
- data template

Instructional Setting:

This activity requires space. A long table (cafeteria table or conference room table) or a hard floor work best. This activity can be done in a special education or general education classroom.

Community Connections and/or Peer Interaction:

Students can work together in small groups or typically developing peers.

Functional Activity/Routine:

This activity encourages functional skills such as turn-taking, following instructions, and cleaning up afterward.

Strategies to Collect Evidence:

For collection of evidence, be sure that each student records a hypothesis and data individually. Provide choice boards or voice output devices to allow all students to participate in responding, assign an adult to collect data on student responses.

Specific Options for Differentiating this Activity:

- Conduct the experiment on a surface that can be accessed by all students.
- Introduce fewer ramp surfaces or more ramp surfaces to this experiment.
- For students with poor fine motor skills, substitute large balls for the cars.
- Allow students to use their preferred "pencil" when writing. This may include a writing utensil, keyboard, alternative pencil, or dictating to a scribe.
- Prepare, as necessary, for each student to make choices and communicate with their preferred method. This may include using augmentative communication.
- Attach a switch to a car to allow students to initiate the movement of the car.