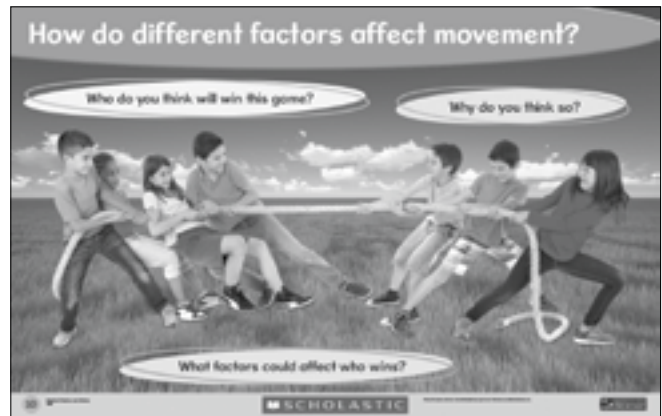


What Factors Affect Movement?



Focus: Students use the inquiry process to investigate how various factors affect movement.

Specific Curriculum Outcomes

Students will be expected to:

- 39.0 investigate factors that affect movement [GCO 1/3]
- 9.0 propose an answer to an initial question or problem and draw a simple conclusion [GCO 2]
- 14.0 communicate procedures and results [GCO 2]
- 40.0 pose new questions that arise from what was learned [GCO 2]

Performance Indicators

Students who achieve these outcomes will be able to:

- communicate their understanding of how they applied forces to speed up, change direction, or stop their objects moving

NOTES:

Attitude Outcome Statements

Encourage students to:

- consider their observations and their own ideas when drawing a conclusion [GCO 4]

Cross-Curricular Connections

Math

It is expected that students will:

- measure length to the nearest non-standard unit by using multiple copies of a unit or using a single copy of a unit [2SS4]

English Language Arts

Students will be expected to:

- interpret, select, and combine information using a variety of strategies, resources, and technologies [GCO 5]
- respond personally to a range of texts [GCO 6]

Getting Organized

Components	Materials	Before You Begin	Vocabulary
• Science Card 9 • IWB Activity 7 • Science Card 10 • <i>What Is the Inquiry Process?</i> poster • IWB Activity 8	• variety of surfaces such as tiles, sandpaper, foam rubber, carpet, etc. • string cut in 2m lengths (2 per pair of students) • paper cups • students' Science Journals • variety of objects including some that roll (marbles, Ping-Pong balls), slide (hockey pucks), and have wheels (toy cars, pull toys) • interlocking cubes • straws and Ping-Pong balls • hairdryer • wind-up toys • variety of objects such as skis, skates, skateboard, snowboard, snowshoes, crampons, hiking poles, scooter, etc.	• Cut string into 2m lengths and cut large holes in the bottoms of the paper cups. • Collect books and videos exploring technologies that make it easier for people to move on different surfaces (e.g., skateboard, snowshoes, crampons, etc.). See <i>Additional Resources</i> on page 59 for some possible Websites.	• surface • friction • resistance • gravity

Safety

- You may choose to have an adult be present while students explore with a hairdryer at high settings.

Science Background

- Friction is the contact force between two objects moving against each other; the kind of surface that objects have affects how objects move against each other.
- Gravity is the force that pulls objects down slopes or makes them fall.
- A force can slow down or speed up an object.
- A force can change the direction in which an object is moving.
- The greater the force is, the greater the change in motion will be.

Possible Misconceptions

- Students may believe the surface on which an object moves does not affect its motion. Investigating various surfaces will help students to realize that rougher surfaces make it harder to move things and that smooth surfaces can speed up objects by reducing friction. However, it is important for students to recognize that all surfaces create some friction.
- Some students believe that a force is put on an object when it is launched (e.g., a thrown ball) and that the force gradually decreases and causes the object to slow and eventually stop when the force is ‘used up.’ Students need plenty of opportunities to investigate how various forces impact the movement of objects.

ACTIVATE

Changing Motion

Invite students to identify two objects and/or living things and describe how they move. Alternatively, you may choose to refer to the Sorting Chart from *Investigating Patterns of Movement* (see pages 30–35). Organize students into pairs and challenge them to choose one object and think of a way to change the way it moves (e.g., go faster, slower, change direction, stop). Pairs can test one or more of their ideas for changing the motion of the object and then share their findings with the class.

What Affects Movement?

Display Science Card 9 and discuss with students some of the various factors that affect movement. Ask:

- Will the skateboard move faster going downhill or on flat ground? Why do you think so?
- Does a flag move more on a windy day or on a still day with no wind? How do you know?
- Does the bicycle move faster on pavement or on rough ground? What is affecting the movement?
- Will the toy car roll better on the wooden floor or the carpet? Why do you think so?





IWB Activity:

- Challenge students to use Activity 7: *Moving on surfaces* (see the Teacher's Website) to identify surfaces that make it easier to move and harder to move in different situations.



Introduce the word “friction” and add it to the Word Wall. Tell students that when two surfaces rub together, a force called friction is produced. This force resists motion. Add any new questions students may have to the I Wonder Wall.

Rough or Smooth?

Show students some different surfaces and ask volunteers to describe how each one feels. Ask:

- **What other materials can you think of that are smooth? Rough?**
- **How do you think a toy car would move on different surfaces?**

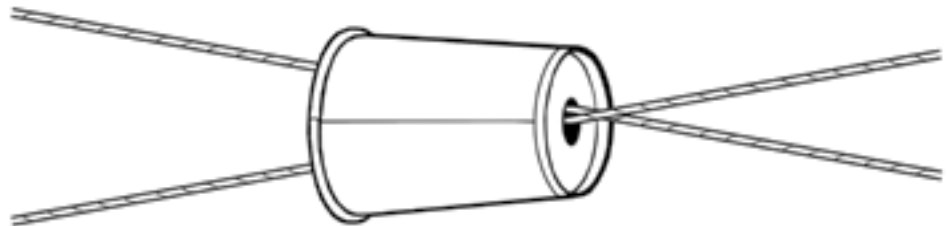
Invite students to roll toy cars over different surfaces such as carpet, the bare floor, and any other surfaces they suggest. Ask:

- **On which surfaces did the car move easily?**
- **Which surfaces made it more difficult to move the car?**
- **Why do you think it's harder to move the car on rougher surfaces?**

CONNECT

Make It Move!

Provide pairs of students with two pieces of string (2 m long) and a sturdy paper cup with a large hole cut in the bottom. Pull both strings through the cup and have students hold an end in each hand. Students will work together to move the cup back and forth at different speeds, by pulling the ends apart and pushing them back together. They can also try to stop the cup in the middle of the strings. Students can make simple conclusions about how moving their hands together and apart will affect the movement of the cup.



Circulate around the room posing questions to students as they investigate. Questions to prompt thinking might include:

- **Can you describe how the cup is moving?**
- **In what direction is the cup moving?**
- **What is causing the cup to move?**
- **What is the cup's position in relation to you?**
- **How has the cup's position changed?**



Students can record their observations in their Science Journals. Invite students to pose new questions that arise from their explorations and record these on the I Wonder Wall.

Tug-Of-War

Tell students that tug-of-war is a traditional Indigenous game that is played at many Annual Assemblies and gatherings and is included in the World Indigenous Peoples Games. Invite students to share any experiences they may have had seeing or playing a game of tug-of-war.

Show students Science Card 10 and discuss the image of the tug-of-war game. Ask students which side they think will win, and why. Then ask students to think of other factors that could affect the outcome, for example, dry vs wet ground; shoes or no shoes; gloves or no gloves; one-hand vs two-hands on the rope. Outside, or in the gym, invite students to test some of the suggested factors.

CONSOLIDATE

Using Forces

Discuss with students how they use forces to start an object moving, slow it down or stop it, and change its direction. Prompt thinking by asking:

- **How do you get a bicycle to start?** (Push on the pedals.)
- **How do you slow down or stop a bicycle.** (Pull on the hand brakes.)
- **How do you change the direction of the bicycle?** (Push or pull on the handlebars.)

Motion Centres

Set up several centres where students can work in small groups to investigate factors that affect movement by changing the motion of an object. At each centre, provide objects that roll (marbles, Ping-Pong balls), slide (hockey pucks), and have wheels (toy cars, pull toys). As well, provide a ramp and a variety of surfaces such as tiles, sandpaper, foam rubber, and carpet.

Have each group generate a question to investigate, such as which surface will allow a marble to roll the farthest. Provide prompts such as:

- **How will you determine how far each marble rolls?** (e.g., use interlocking cubes to measure the distance it travels on the surface from the bottom of the ramp)



Review the *What Is the Inquiry Process?* poster with students and encourage them to follow the process for their investigations. Students should make a prediction; make a plan; conduct their investigation; record observations; then draw conclusions based on their observations.

Students can share their investigations and explain the factors that affected movement. After all students have had a chance to investigate, hold a class discussion about their experiences. Prompts might include:

- **On which surface(s) does the object move the easiest?**
- **On which surface(s) does the object have the most difficulty moving?**
- **Are there any surfaces that don't seem to make a difference to the movement of the objects?**
- **Why do certain surfaces affect the motion of objects?**



Ask what new questions students may have and record these on the I Wonder Wall.

Students can investigate other factors that affect movement, such as:

- Provide a straw and a Ping-Pong ball for students to investigate changes in force. Students can experiment with moving the Ping-Pong ball faster and slower. Variations may include teams of students racing to get their ball into a cup, using differently sized straws, blowing harder and softer, or moving the ball over different surfaces. Alternatively, students can create a maze out of interlocking cubes and blow the ball through the maze with a straw. (Challenge students to change the direction of the ball by incorporating left/right turns, over/under, etc.).
- Students can use a hairdryer with various settings to determine the force required to suspend a Ping-Pong ball in the air.
- Students can make predictions and investigate how the number of turns affects how fast and far a wind-up toy moves. They can count the number of turns and measure how far it goes. Alternatively, students can hold a wind-up toy race to see which toy will cross the finish line first. Have students suggest reasons for why one toy is faster/slower than another.
- Students can make a marble move over the ground or a table in as many ways as they can. Ask students to describe the methods they used to make the marble move, identifying them as pushes or pulls, or particular directions.

IWB Activity:

- Students can use Activity 8: *More friction, less friction* (see the Teacher's Website) to identify the situations where friction is greater.



EXPLORE MORE



Helpful Technology

Have students look at Science Card 9 and discuss how the technologies shown on the card (e.g., skateboard, bicycle) make it easier for people to move on different surfaces. If possible, bring in a variety of objects (e.g., skis, skates, skateboard, snowboard, snowshoes, crampons, hiking poles, scooter, etc.) for students to examine. Students can also use books and videos to explore more technologies.

Discuss with students what these objects do for us to make movement easier. Ask how each item helps us and have students identify one surface on which each object helps movement and one surface on which the object would make movement harder.

Alternatively, students could explore the reasons for the wide variety in the design of shoes and in particular the soles of shoes created for specific purposes (e.g., dancing, running, rock climbing, etc.). Students can present their information on a poster or flyer for display in the classroom.

Friction Stories

Invite students to write a story about a time when they needed friction to slow them down, for example, running shoes on the gym floor or winter boots on a patch of ice. Or, students may write about a time when they wanted less friction to make something go faster such as waxing the bottom of skis or a snowboard.