



Grade **2** Relative Position and Motion

TEACHER'S GUIDE

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Relative Position and Motion

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Let's Do Science, Newfoundland and Labrador

Grade 2 Unit 3: Relative Position and Motion Teacher's Guide

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175 Hillmount Road, Markham, Ontario, Canada, L6C 1Z7.

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ISBN 978-1-4430-4328-1

Printed in Canada.

10 9 8 7 6 5 4 3 2 1 17 18 19 20 21



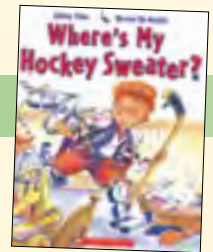
Welcome to the *Relative Position and Motion* Unit

In this unit, students develop their understanding of the ways objects and living things move, and how forces affect movement. Students will also learn how to describe the motion of an object in terms of a change in position relative to other objects, and the position of an object relative to other positions or stationary objects. Multiple components will engage students and support learning of the specific science concepts.

Science Cards

This collection of 12 Science Cards will support students' exploration of relative position and motion with each large-format card focusing on a different concept. The bright, colourful photographs and detailed illustrations will engage students and give them multiple opportunities to explore a variety of concepts. These stand-alone cards can also be used at centres to stimulate student explorations. Also, digital versions of these cards are available on the Teacher's Website to be used with an Interactive Whiteboard.





Science Read Alouds

Two Read Aloud texts allow you to introduce and engage students with science concepts. *Ready, Set, Go!* by Robert Munsch tells the humorous story of Miranda who is trying to find her father to give him a bottle of water as he runs in his very first big race. The engaging illustrations show the motion of Miranda in terms of her changing position in relation to the other racers.

Where's My Hockey Sweater? by Gilles Tibo presents Nicholas who, before the first hockey practice of the season, must find all of his equipment—and find it fast! The text and illustrations showing Nicholas' search highlight the position of objects relative to other positions or stationary objects.



Anchor Video

The Anchor Video: *Relative Position and Motion*, found on the Teacher's Website, introduces students to essential questions about the position and changes in position of objects; patterns of movement; factors that can affect movement; and the forces of push, pull, and friction. The video gives a number of examples to activate students' thinking and to promote questions.

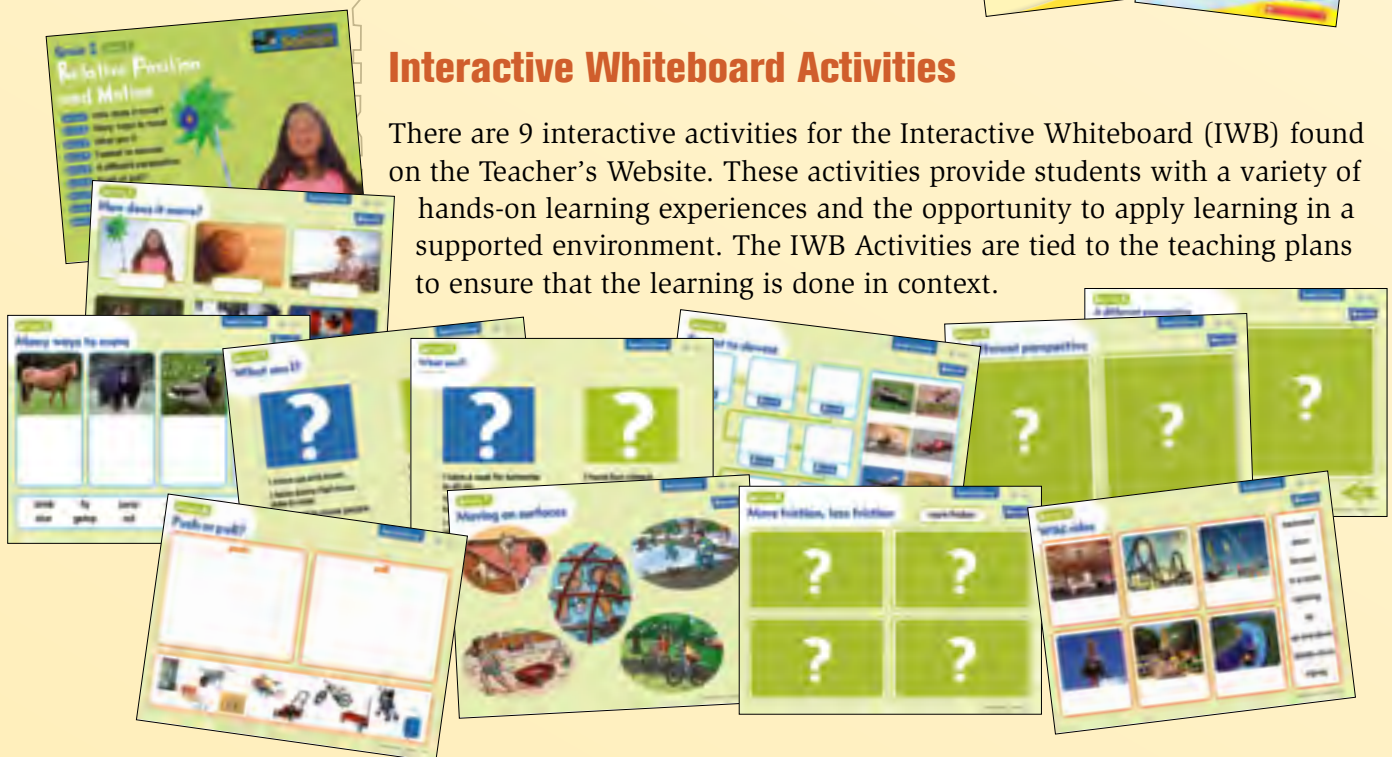
Posters

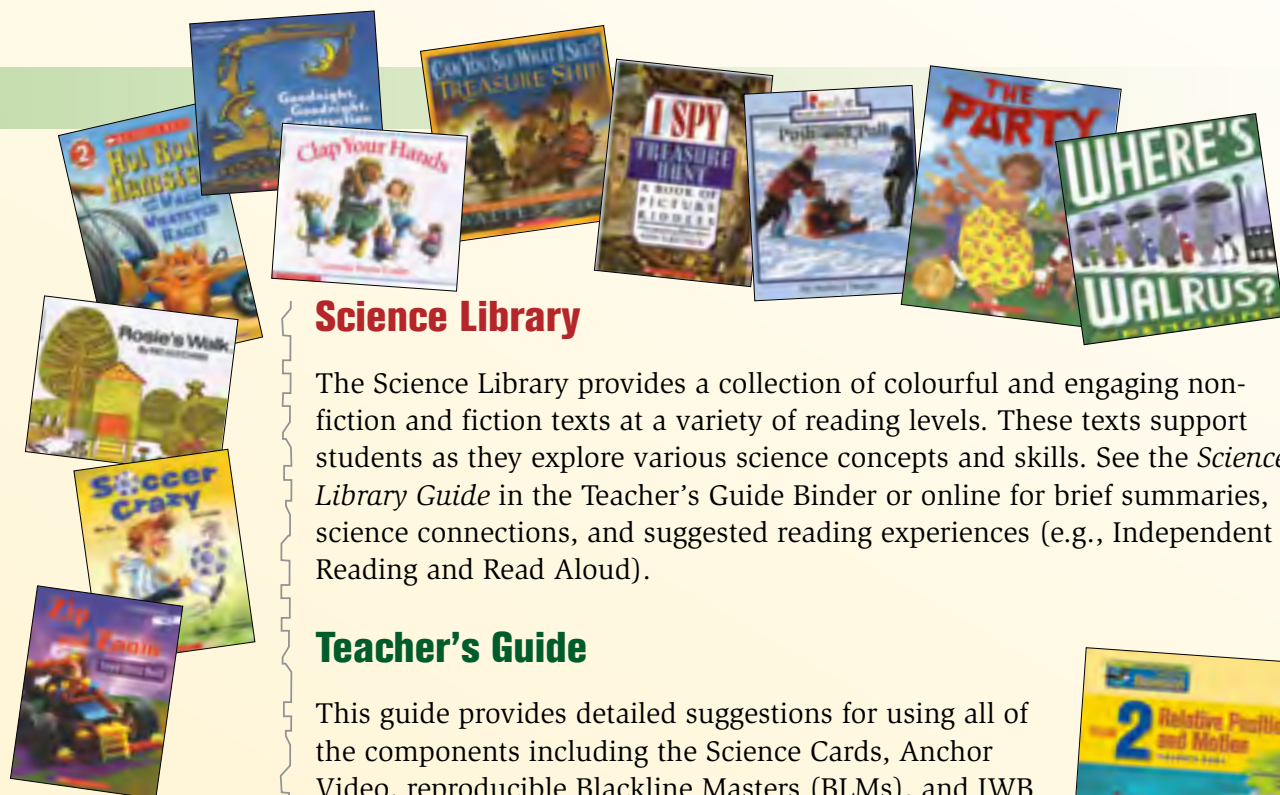
Two classroom posters—*What Is the Inquiry Process?* and *What Is the Design Process?*—will support students as they follow the steps for guided and open inquiries and learn to use the design process to create a solution to a problem.



Interactive Whiteboard Activities

There are 9 interactive activities for the Interactive Whiteboard (IWB) found on the Teacher's Website. These activities provide students with a variety of hands-on learning experiences and the opportunity to apply learning in a supported environment. The IWB Activities are tied to the teaching plans to ensure that the learning is done in context.





Science Library

The Science Library provides a collection of colourful and engaging non-fiction and fiction texts at a variety of reading levels. These texts support students as they explore various science concepts and skills. See the *Science Library Guide* in the Teacher's Guide Binder or online for brief summaries, science connections, and suggested reading experiences (e.g., Independent Reading and Read Aloud).

Teacher's Guide

This guide provides detailed suggestions for using all of the components including the Science Cards, Anchor Video, reproducible Blackline Masters (BLMs), and IWB Activities with your students. Visual cues such as book covers, thumbnail images, and icons highlight the use of each component along with tools such as Science Folders and Journals, the Word Wall, and I Wonder Wall. Strategies and tools you need to assess students' learning, such as rubrics and checklists, are also included.



Embedded within the teaching plans are connections to Guided, Shared, and Wordless texts along with Conversation Cards from *Literacy Place for the Early Years*, Grade 2 that relate to the concepts explored in *Relative Position and Motion*.

Teacher's Website



In addition to the Science Cards, Anchor Video, and IWB Activities mentioned above, this website provides a digital copy of the Teacher's Guide for this unit along with access to an image bank containing the variety of photographic images found on the Science Cards and IWB Activities. These images may be used for teachers to create new IWB Activities or for students to incorporate into presentations.

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Planning Guide for *Relative Position and Motion*

Teaching Plans	Specific Curriculum Outcomes	Components	Materials	Literacy Place Connections
How Do Objects and People Move? Students identify living and non-living things that move and describe the different movements.	Skills [GCO 2] • 1.0 • 2.0 STSE/K [GCO 1/3] • 38.0	• Science Card 1 • Anchor Video: <i>Relative Position and Motion</i> • BLM <i>Neighbourhood Walk</i> • Science Card 2 • IWB Activity 1 • IWB Activity 2	• students' Science Folders • variety of objects from the Curiosity Centre	• <i>Justin's New Bike</i> (Guided Reading, Level F)
How Can You Describe the Motion of an Object? Students develop positional language and describe the change in position of objects.	Skills [GCO 2] • 2.0 STSE/K [GCO 1/3] • 33.0	• <i>Ready, Set, Go!</i> (Read Aloud) • Science Card 3 • IWB Activity 3 • IWB Activity 4	• digital cameras or tablets • sporting event videos	• <i>Beaver is Lost</i> (Wordless Book – Active Learning Kit)
Describing an Object's Position Students describe the relative position of objects and follow instructions to place objects in identified locations.	Skills [GCO 2] • 27.0 • 36.0 STSE/K [GCO 1/3] • 34.0 • 35.0	• <i>Where's My Hockey Sweater?</i> (Read Aloud) • Science Card 4 • Science Card 5 • BLM <i>Pirates and Props</i>	• copies of 100s chart (1 per student) • highlighters, markers, colouring pencils, or crayons • Sticky Tack (optional) • digital camera (optional) • students' Science Journals	• <i>Where's Walrus?</i> (Wordless Book – Active Learning Kit) • <i>Movie Poster: How Anansi Outsmarted Snake</i> (Conversation Card # 15 – Active Learning Kit) • <i>Map: Pine Valley Wildlife Centre</i> (Conversation Card # 13 – Active Learning Kit)
Describing the Position of an Object From Different Perspectives Students view and describe the position of objects from different perspectives.	Skills [GCO 2] • 2.0 STSE/K [GCO 1/3] • 37.0	• Science Card 6 • IWB Activity 5	• Rubik's Cubes (1 per group of 4 students) • large-grid graph paper • soccer ball • various board games	

Teaching Plans	Specific Curriculum Outcomes	Components	Materials	Literacy Place Connections
Investigating Patterns of Movement Students investigate patterns of movement and discover how the forces of push and pull are necessary to initiate movement.	Skills [GCO 2] • 6.0 • 2.0 STSE/K [GCO 1/3] • 38.0	- Science Card 1 (optional) - Science Card 2 (optional) - BLM <i>Sorting Chart</i> - Science Card 7 - IWB Activity 6 - Science Card 8 - Science Card 3 (optional)	- students' Science Folders - pull toy - variety of objects from the Curiosity Centre - measuring tools - magnifying lenses - recording materials - students' Science Journals 2 large dice - digital camera or tablet - old magazines	<i>Come to the Pow-wow!</i> (Shared Reading – Synthesizing Strategy Unit)
What Factors Affect Movement? Students use the inquiry process to investigate how various factors affect movement.	Skills [GCO 2] • 9.0 • 14.0 • 40.0 STSE/K [GCO 1/3] • 39.0	- 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.	
Design Challenge: Building a Roller Coaster Students explore materials and tools then use the design process to build their own 'roller coasters.'	Skills [GCO 2] • 16.0 • 31.0 • 32.0	- Science Card 11 <i>What Is the Design Process?</i> poster - Science Card 12 - IWB Activity 9 - BLM <i>Two Stars and a Wish</i>	- selection of commercially produced games such as Mouse Trap, Hot Wheels Racetrack, or a marble maze - large variety of building materials and tools such as cardboard rolls; PVC pipe, pool noodles, Hot Wheels tracks; funnels; craft sticks; paper, aluminum, or Styrofoam plates; socks; duct, packing, or masking tape; glue; staples; string; shoelaces; ribbon; paper clips; paper fasteners; clothespins; Playdough; Sticky Tack; pipe cleaners; plastic, twist, or cable ties; wire - marbles, Ping-Pong balls, or golf balls - students' Science Journals - tablets (optional)	

Preparing for the Unit

1. Curiosity Centre

The Curiosity Centre gives students an opportunity to investigate science ideas and tools through active participation, free exploration, and independent play. In this hands-on centre, students can explore objects related to relative position and motion.

The Curiosity Centre could have

- toy cars and other wheeled toys, including pull toys, wind-up toys
- yo-yos, button string zoomers, spinning tops, gyroscopes
- pendulum, metronome
- rubber balls, die
- hockey pucks, shuffleboard disks
- marbles, Ping-Pong balls
- salad spinner, hand mixer, corkscrew
- dominoes, Tiddleywinks game
- cans
- Rubik's Cube
- scissors, stapler
- variety of surfaces such as carpet samples, rugs, corrugated cardboard, foam rubber, linoleum, vinyl tile, hardwood, sandpaper, waxed paper
- magazines and newspapers with photographs showing movement of different kinds

Check the centre frequently to ensure it is well stocked with items. Invite students to contribute to the centre by bringing in items or photographs related to relative position and motion. Remind students to tidy up the materials when they are finished.

Note: You may choose to display new items every few days or introduce items one at a time throughout the unit.

2. Science Journals and Folders



Check that students are recording appropriately in their Science Journals ensuring that

they date each entry and record ideas using sketches with labels, lists of words, or sentences. Continue to encourage them to add new questions or ideas to their Journals as often as they like.

Remind students that they should store completed BLMs, drawings, stories, etc. that are related to the *Relative Position and Motion* unit in their Science Folders.

3. Word Wall



Add any relevant science terminology to the Word Wall throughout the unit.

Emphasize the importance of using precise scientific words while explaining and expressing science concepts and when sharing science learning. Urge students to use the terms as often as possible as they work through the unit.

4. I Wonder Wall



Continue to build the I Wonder Wall throughout the unit by posting students' questions as they arise. Refer to the I Wonder Wall often and select questions that students may be ready to answer.

5. Reading Centre

Add texts (books, magazines, and photographs) relating to relative position and motion to the Reading Centre. Or, you may choose to include these texts in the Curiosity Centre to stimulate discussion and questions. The titles in the Science Library will help start off a collection of books. Also, refer to the list of texts pertaining to Relative Position and Motion in the Additional Resources section of this guide (pages 58–59).



Specific Curriculum Outcomes

- 1.0 pose questions that lead to exploration and investigation [GCO 2]
- 2.0 communicate using scientific terminology [GCO 2]
- 38.0 investigate different patterns of movement [GCO 1/3]

Students who achieve these outcomes will be able to:

- ## NOTES:

Attitude Outcome Statements

Encourage students to:

- be sensitive to the needs of other people, other living things, and the local environment [GCO 4]

Cross-Curricular Connections

English Language Arts

Students will be expected to:

- communicate information and ideas effectively and clearly, and to respond personally and critically [GCO 2]
- interpret, select, and combine information using a variety of strategies, resources, and technologies [GCO 5]

Getting Organized

Components	Materials	Before You Begin	Vocabulary
• Science Card 1 • Anchor Video: <i>Relative Position and Motion</i> • BLM <i>Neighbourhood Walk</i> • Science Card 2 • IWB Activity 1 • IWB Activity 2 Literacy Place: • <i>Justin's New Bike</i> (Guided Reading, Level F)	• students' Science Folders • variety of objects from the Curiosity Centre	• Select music to which students can move in various ways. • Invite an Elder or an Indigenous Knowledge Keeper to visit the classroom and explain traditional ways to observe, respect, and interact with wild animals. This person could discuss how to use knowledge about the different ways animals move to hunt or trap them.	• movement • motion • direction • pattern

Safety

- Review school safety rules before students go outside for an investigation.

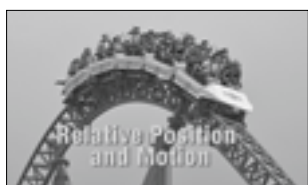
Science Background

- We can describe how something moves by saying how fast it is going and what sort of path it takes. This is a pattern of movement.
- Animals and objects move in many different ways: they move in air, on land, or in water.

Possible Misconceptions

- Young students may think that only living things move. Participating in the Neighbourhood Walk activity will help students to realize that both living and non-living things move.
- Students may think of movement as big changes in position and may not realize that even an almost imperceptible change in position is also movement.

ACTIVATE



What Moves?

Ask students what they know about how things move. Invite students to share examples of objects they have seen move and demonstrate the movement. Display Science Card 1 and have students examine the photos of objects on the card and identify what moves and how it moves. Ask:

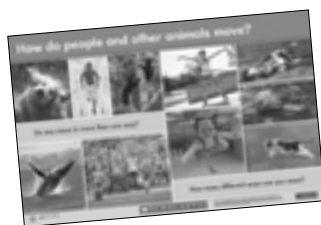
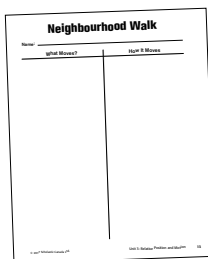
- Do all the pictures show something that is moving?
- How do we know something is moving?

Write the words “movement” and “motion” on the Word Wall. Then invite students to record any questions they have about movement. Add these questions to the I Wonder Wall.

Anchor Video

Play the Anchor Video: *Relative Position and Motion* which is located on the Teacher’s Website. Set a focus for viewing by asking students to think about different types of movement and how movement can be affected or changed. You may choose to pause the video to allow students to answer questions or to discuss any questions which students may have.

CONNECT



Neighbourhood Walk

Take students on a neighbourhood or school walk to identify objects that move. Provide copies of BLM *Neighbourhood Walk* for students to record their observations. Upon returning to the classroom have students participate in a question circle about their observations. Provide prompts such as:

- What objects did you see and how did they move?
- Which objects moved in more than one way?
- How did you move?

Have students store their completed BLMs in their Science Folders.

How We Move

Show students Science Card 2 and discuss the different ways that people and animals move. Ask:

- How many different ways can we move?
- What is the biggest movement you can make?
- What is the smallest movement you can make?

Invite students to take turns imitating the ways in which animals move. The other students guess the animal being portrayed and come up with a verb to describe the movement such as hop, fly, slither, crawl, etc. Create a Ways to Move chart on the IWB or on chart paper and add the terms students suggest.

IWB Activity:

- Have students label the way objects and living things move using Activity 1: *How does it move?* (see the Teacher’s Website).



Move to the Music

Play some music and invite students to move in different ways around the room (e.g., in a circle, forward/backward, side-to-side, up and down, spin, jump, etc.). Choose a variety of students to demonstrate various movements and ask them to use one or two words to describe how they moved. Ask:

- What direction did you move in?
- Was there a pattern to the movement?



Add “direction” and “pattern” to the Word Wall. Add any new terminology related to movement to the Ways to Move chart.



Literacy Place Connection:

Share *Justin's New Bike* (Guided Reading, Level F) with students and help them to identify the movement in the illustrations (e.g., up, down, around, over).

CONSOLIDATE

IWB Activity:

- Challenge students to sort the movements according to each living thing using Activity 2: *Many ways to move* (see the Teacher's Website).



Illustrating Movement

Have students draw a picture to depict different types of movement and have them label the movements in the picture. Encourage students to use arrows to indicate the direction of the movements.

How Things Move

Invite students to choose two or three objects from the Curiosity Centre and explain to a partner how they move.

Animal Movements

Invite an Elder or an Indigenous Knowledge Keeper to visit the classroom and explain traditional ways to observe, respect, and interact with wild animals. This person could discuss how to use knowledge about the different ways animals move to hunt or trap them.

EXPLORE MORE

Movement Words

Students can choose a movement word such as “glide,” find out what it means, report back to the class, and add the word to the class Ways to Move chart.

Neighbourhood Walk

Name: _____

How Can You Describe the Motion of an Object?



Focus: Students develop positional language and describe the change in position of objects.

Specific Curriculum Outcomes

Students will be expected to:

- 33.0 describe the motion of an object in terms of a change in position relative to other objects [GCO 1/3]
- 2.0 communicate using scientific terminology [GCO 2]

Performance Indicators

Students who achieve these outcomes will be able to:

- identify and describe changes in position relative to other objects and people
- use accurate descriptive terminology to describe changes in position

NOTES:

Attitude Outcome Statements

Encourage students to:

- recognize the role and contribution of science in their understanding of the world [GCO 4]

Cross-Curricular Connections

Math

It is expected that students will:

- describe order or relative position, using ordinal numbers (up to 10th) [2N3]

English Language Arts

Students will be expected to:

- speak and listen to explore, extend, clarify, and reflect on their thoughts, ideas, feelings, and experiences [GCO 1]
- create texts collaboratively and independently, using a variety of forms for a range of audiences and purposes [GCO 9]

Getting Organized

Components	Materials	Before You Begin	Vocabulary
• <i>Ready, Set, Go!</i> (Read Aloud) • Science Card 3 • IWB Activity 3 • IWB Activity 4 Literacy Place: • <i>Beaver is Lost</i> (Wordless Book – Active Learning Kit)	• digital cameras or tablets • sporting event videos	• Find videos of sporting events for students to describe the movement of an object or person. See <i>Additional Resources</i> on page 59 for one possible Website.	• position • direction • faster • slower • closer • further • toward • away from

Science Background

- Relative position is a point defined with reference to another position, either fixed or moving.
- The motion of an object is always judged with respect to some other object or point.

Possible Misconceptions

- Some students may misuse “right” and “left.” Give students plenty of opportunities to identify whether an object or person is to their right or left. Have students identify their right and left hands. Encourage them to use the body parts as a concrete reference point. Explain that when identifying the position of an object or person in an image, “left” and “right” are from the viewer’s point of view.

ACTIVATE

Changing Position

Lead a class game of “Mother May I” or “Simon Says” to have students change position (e.g., move closer to the window, move away from your chair). Once you have done several rounds, invite volunteers to lead the game.



Explain that a position is the place where someone or something is in relation to other people or things. Tell students that when they moved, they changed their position. Add the term “position” to the Word Wall.

Read Aloud: *Ready, Set, Go!*



Summary

Miranda goes to get water for her dad who’s running in his first big race. But when the starting horn goes off, Miranda has to run to find him.

Before Reading

Show students the cover of the book and read the title. Ask:

- **What does the phrase “Ready, Set, Go!” make you think of?** (a race)
- **Have any of you ever watched a race or raced with your friends?**
- **Do runners stay in the same order throughout the race or do they change position?**

Discuss with students how the runners change position by, for example, passing other people in the race. Ask students to listen as you read and to pay close attention to the illustrations to discover how the positions of Miranda and the other runners change in this story. You may consider having students model the position of characters in the story using toy figures or by acting out the race.

During Reading

As you read the story to students, pause frequently to discuss the text and illustrations. Clarify that students should describe positions as they appear when looking at the pages. Allow students to describe the positions of people on the pages before offering prompts as necessary. Prompts for discussion could include:

Pages 2–3:

- **Where is Miranda’s dad in relation to Miranda?** (beside her, to the right of her)
- **Where is Miranda in relation to her dad?** (beside him, to the left of him)

Pages 4–5:

- **What direction is Miranda moving?** (toward the car, away from the washroom)
- **What is the position of the hiker in relation to Miranda?** (to the left of her)

- **What is the position of the hiker in relation to the washroom?** (closer to the washroom than Miranda is)

Pages 6–7:

- **Who is in front—the woman in pink or the man in orange and green?** (woman in pink)

Pages 10–11:

- **What is Miranda’s position in relation to the man?** (ahead, to the left of the man)
- **What direction is Miranda moving?** (away from the man)

Pages 12–13:

- **Where are Miranda and the man in relation to the other runners?** (Miranda and the man are ahead, the other runners are behind them.)

Pages 14–15:

- **The text says that “Miranda caught up to the next runner.” Does that mean that Miranda was moving closer to the woman or further away?** (closer)
- **Who is ahead in the illustration?** (Miranda, she is in front of the woman)

Pages 16–17:

- **Is Miranda moving faster or slower than the other runners? How do you know?** (Miranda is moving faster as she is ahead of the others in the race.)

Pages 22–23:

- **What is the position of the man in relation to Miranda?** (he is ahead of her; the man is 1st and Miranda is 2nd)
- **Is Miranda closer to or further away from the pack of runners than she was on pages 16–17?** (further away)

Pages 24–25:

- **What is the position of Miranda in relation to the finish line?** (she is 1st at the finish line)

After Reading

Have students write and illustrate a short story about Miranda’s next race. Ask them to include positional language in their narratives. Invite students who are interested to read their stories aloud to the rest of the class. Post all of the students’ stories in the classroom or create a class book.

CONNECT



Spot the Differences

Display Science Card 3 and ask students to compare the two illustrations to find the differences. Remind them to describe the movement or change of position relative to other objects in the illustration. Students may also describe the changes in relation to the objects’ original position (e.g., the man has moved further up the ladder; the cement truck has moved forward).

IWB Activity:

Students can use Activity 3: *What am I?* (see the Teacher's Website) to identify objects according to their movements.



Positional Language

Take students to the gym. Have pairs of students roll balls between them and communicate how the ball is moving. Circulate among the pairs and prompt by asking questions such as:

- Is the ball moving fast or slow?
- Is it moving toward you or away from you?
- Is it getting closer or further away?

You might set up some targets such as cones or beanbags and challenge students to see who can roll their ball closer to, further away from, to the left, and to the right of the targets.



Literacy Place Connection:

Revisit or share *Beaver is Lost* by Elisha Cooper. This mostly wordless book shares the adventures of a beaver that gets lost but finds his way home. Challenge students to describe beaver's changing position as the story unfolds in the illustrations.

CONSOLIDATE

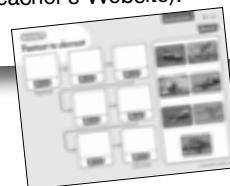
Make a Video

Have students work in small groups to create a short video or develop a presentation to explain the difference between two related terms such as “faster” and “slower;” “closer” and “further;” or “toward” and “away from.” Add these terms to the Word Wall.



IWB Activity:

Challenge students to sequence the objects and living things in order from fastest to slowest using Activity 4: *Fastest to slowest* (see the Teacher's Website).



EXPLORE MORE

Sports Story

In pairs, students can watch a sporting event with the sound off and take turns being the commentator, describing the movement of one object or person in relation to other objects and people for the ‘viewing audience.’

Describing an Object's Position



Focus: Students describe the relative position of objects and follow instructions to place objects in identified locations.

Specific Curriculum Outcomes

Students will be expected to:

- 27.0 identify problems to be solved [GCO 2]
- 34.0 describe the position of an object relative to other positions or stationary objects [GCO 1/3]
- 35.0 place an object in an identified position relative to another object or position [GCO 1/3]
- 36.0 follow a simple procedure [GCO 2]

Performance Indicators

Students who achieve these outcomes will be able to:

- use positional language to identify the position of objects relative to other objects or positions
- give and follow instructions to place an object in a specific location relative to another object

NOTES:

Attitude Outcome Statements

Encourage students to:

- show interest in and curiosity about objects and events within the immediate environment [GCO 4]

Cross-Curricular Connections

English Language Arts

Students will be expected to:

- communicate information and ideas effectively and clearly, and to respond personally and critically [GCO 2]
- respond personally to a range of texts [GCO 6]
- use writing and other forms of representation to explore, clarify, and reflect on their thoughts, feelings, experiences, and learnings; and to use their imaginations [GCO 8]

Getting Organized

Components	Materials	Before You Begin	Vocabulary
• <i>Where's My Hockey Sweater?</i> (Read Aloud) • Science Card 4 • Science Card 5 • BLM <i>Pirates and Props</i> Literacy Place: • <i>Where's Walrus?</i> (Wordless Book – Active Learning Kit) • <i>Movie Poster</i> (Conversation Card # 15 – Active Learning Kit) • <i>Map</i> (Conversation Card # 13 – Active Learning Kit)	• copies of 100s chart (1 per student) • highlighters, markers, colouring pencils, or crayons • Sticky Tack (optional) • digital camera (optional) • students' Science Journals	• Arrange to laminate students' coloured images from BLM <i>Pirates and Props</i>.	• stationary Positional terms such as: • above • below • beside • between • near • far

Science Background

- Relative position is a point defined with reference to another position, either fixed or moving.
- The motion of an object is always judged with respect to some other object or point.

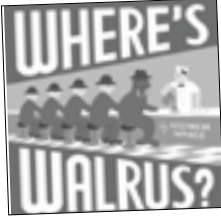
ACTIVATE

I Spy



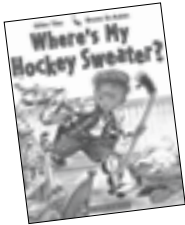
Play a game of “I Spy” with students using riddles that describe the relative position of various objects, e.g., “I spy something that is beside the chair, in front of the bookcase.” With students, brainstorm specific terms of reference to describe position (e.g., near the door, below the desk, between the windows). Add the position words to the Word Wall.

Literacy Place Connection:



Revisit or share *Where's Walrus?* by Stephen Savage. Challenge students to describe Walrus' position relative to other positions or stationary objects shown in the illustrations. Explain that stationary objects stay in one place and don't move. Add “stationary” to the Word Wall.

Read Aloud: *Where's My Hockey Sweater?*



Summary

Nicholas needs to hurry and search through his messy room and the rest of the house to find his hockey gear in time for the first practice of the season.

Before Reading

Ask students to think of a time when they searched for something they had lost. Ask:

- **Where did you search? Did you look inside a drawer or under your bed?**

Tell students that you will be reading a story about a boy who is searching everywhere for his hockey equipment. Ask them to listen as you read aloud and to look closely at the illustrations so that they can use positional language to describe where Nicholas looked for and found his missing equipment.

During Reading

As you read the story to students, pause frequently to discuss the text and illustrations. Alternate between asking students to respond in a whole group or with a partner. Prompts for discussion could include:

- **Do you think it would be difficult to find something in Nicholas' messy room?**
- **Where did Nicholas find his shoulder pads?** (on the floor, under shirts, socks, and pyjamas)
- **Where did he look for his helmet but found his shin guards instead?**

- Describe the location of his rain boots, ski boots, and flip-flops.
- Where were his hockey pants?
- Describe where Nicholas looked for his skates. Where did he finally find them?
- Where did Nicholas leave his skates as he looked for the rest of his equipment?
- Where did Nicholas look for his helmet this time?
- Where was his hockey stick?
- What strategy did Nicholas use to help him find his sweater in his messy bedroom? (he cleaned up the mess)
- Everyone tells Nicholas that he needs to keep track of his stuff. Do you agree that this is important? Why or why not?

After Reading

Place *Where's My Hockey Sweater?* in the Reading Centre and invite pairs or small groups of students to play a game of "I Spy" using the book. One student can identify an object shown on the page and the partner or another group member can use positional language to describe where the object is located. Students can take turns choosing the objects to be found. If a student would like to play a game of "I Spy" alone, encourage them to find and record the location of the cat in each illustration.

CONNECT



Choose a Toy

Ask students to think about a problem that could be solved by describing the position of an object (e.g., calling home to have a parent find an object, such as swim goggles or a book; or identifying a specific item in a store). Then display Science Card 4 and tell students that they are customers at a toy store. Ask volunteers to pick out a robot toy they would like to buy. Since there are several of the same robot, ask them to describe the object as specifically as possible according to the object's position (e.g., I'd like the black robot that is beside the blue and red robot on the top shelf above the large green robot.).



Literacy Place Connection:

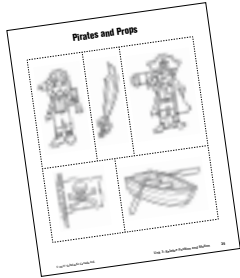
Display *Movie Poster: How Anansi Outsmarted Snake* (Conversation Card # 15). Identify the character of Anansi the spider and then invite students to describe the positions of the various characters relative to each other.

Colour a Path

Provide a copy of a 100s chart to each student. Give oral directions for students to colour a path with a given starting point (e.g., start at #26, colour 3 spaces

to the right and then 4 spaces down), then have students identify the number. After several teacher-led games, students can play in pairs or small groups taking turns to give the oral directions.

CONSOLIDATE



Treasure Map

Show the students Science Card 5. Discuss the treasure map with the students, asking them to find and describe the position of objects shown relative to other positions or stationary objects on the map. Alternatively, you may choose to display the digital version with a grid over the image (see the Teacher's Website).

Then, provide copies of the BLM *Pirates and Props* and invite students to cut out and colour the items they would like to add to the map. Students can give directions to place an object or person in an identified position and have another student place the item as directed. (If the cut-outs are laminated, they can be re-used repeatedly and attached to the card with Sticky Tack.)

Note: The use of a compass rose is beyond expectation for Social Studies 2. However, students who are able may be shown how to use the compass rose as another way to describe the relative position of objects on the map.

Toy Shelf

Create a toy shelf from objects found in the classroom and direct students to add additional toys, or to move existing toys, to specific locations on the shelf. After several experiences, invite students to take turns giving the directions.

Barrier Game

Invite students to play a barrier game with a partner. Students place small objects on a grid and then give clues for their partner to find them. Or, students could play a modified game of battleship. When students miss, their partner gives clues (e.g., number of rows up or down, or columns to left or right).



Literacy Place Connection:

Display *Map: Pine Valley Wildlife Centre* (Conversation Card # 13) and encourage students to use positional language to describe how to find the location of specific buildings or locations on the map. Alternatively, students could work in pairs at a centre taking turns to direct each other to find and identify specific locations on the map.

EXPLORE MORE

Here I Am

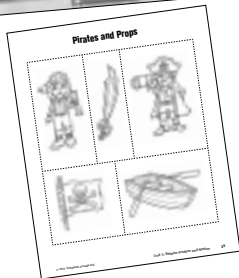
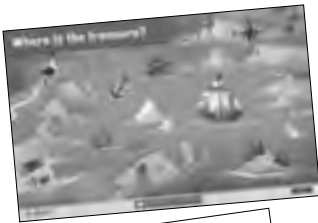
Take a photo of your class on risers or stairs. Display the photo and invite students to describe the position of a classmate relative to their own position in the photograph (e.g., Carlo is three rows behind me and two students to the left).



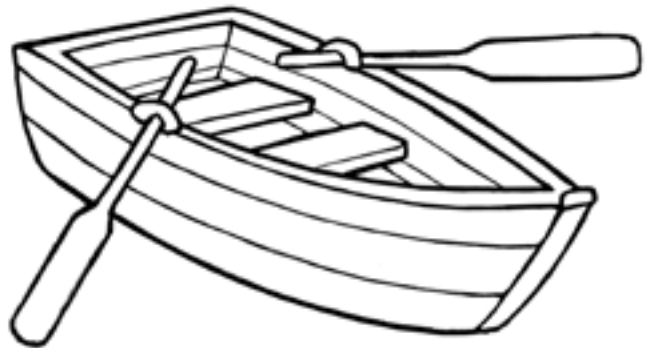
Or, you might take a photo of 6 or 10 students creating a human pyramid in the gym. (Be sure to place gym mats on the floor.) Students can draw a representational diagram of the photo in their Science Journals and record the position of each student relative to the other students in the photograph.

Adventure Story

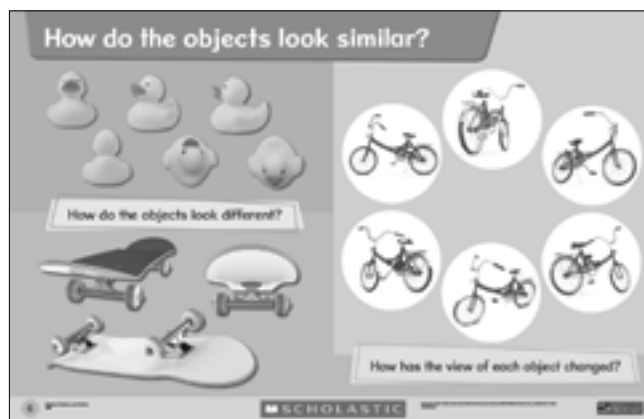
Students can use the map on Science Card 5 and the BLM *Pirates and Props* images as the basis for an oral or written adventure story. They can then share their story, moving the characters and props to illustrate the action. Encourage students to use the scientific terminology related to relative position and motion in their stories. Alternatively, a second student could act out the actions while the first student tells or reads their story aloud.



Pirates and Props



Describing the Position of an Object From Different Perspectives



Focus: Students view and describe the position of objects from different perspectives.

Specific Curriculum Outcomes

Students will be expected to:

- 37.0 describe the position of objects from different perspectives [GCO 1/3]
- 2.0 communicate using scientific terminology [GCO 2]

Performance Indicators

Students who achieve these outcomes will be able to:

- look at various perspectives of the same object and explain in what ways the object appears to be similar and different
- represent objects from different perspectives using drawings and oral descriptions
- describe the position of objects from different perspectives

NOTES:

Attitude Outcome Statements

Encourage students to:

- appreciate the importance of accuracy [GCO 4]
- willingly observe, question, and explore [GCO 4]

Cross-Curricular Connections

English Language Arts

Students will be expected to:

- communicate information and ideas effectively and clearly, and to respond personally and critically [GCO 2]
- create texts collaboratively and independently, using a variety of forms for a range of audiences and purposes [GCO 9]

Getting Organized

Components	Materials	Before You Begin	Vocabulary
• Science Card 6 • IWB Activity 5	• Rubik's Cubes (1 per group of 4 students) • large-grid graph paper • soccer ball • various board games	• Bookmark an aerial view of the local community on Google Maps™. • Select materials to mark the 'bases' in soccer baseball.	• perspective • point of view • front-view • back-view • side-view • top-view • bottom-view • near • far

Science Background

- The position of an object is relative and depends upon the reference point or perspective used to describe it. One student's reference point will result in a different description of an object's position from that of another student.

Possible Misconceptions

- Young students tend to view objects only from their own point of view. Encouraging them to change position when viewing a stationary object reinforces that while perspectives may change, the object does not change.

ACTIVATE



My Perspective

Place a Rubik's Cube (or other object) in the middle of four students. Have each student colour a 3 x 3 grid in their Science Journals to represent the side facing them. Students can then compare their representations with group members to illustrate how observations change based on perspective.



To reinforce this concept, have students move to personally view the object from each perspective. Invite students to post any questions they may have regarding perspective on the I Wonder Wall.

CONNECT



IWB Activity:

- Students can look at items viewed from different perspectives and identify the two that are the same using Activity 5: *A different perspective* (see the Teacher's Website).



Multiple Perspectives

Display Science Card 6 and have students examine the photos showing three objects from multiple perspectives. Discuss how the images differ depending on perspective. Ask:

- In what ways does the object appear to be similar?
- In what ways does it appear to be different?
- Has the object changed?

Clarify for students that the object has not changed, the perspective or point of view is different. Add the terms “perspective” and “point of view” to the Word Wall.

Have students identify the perspective in the images of each object on the card such as front-view, back-view, side-view, top-view, and bottom-view. Add these terms to the Word Wall.

Changing Points of View

Have two students sit in the centre of the room. Arrange the rest of the class into four groups and have them sit in a circle around the students in the 3, 6, 9, and 12 o'clock positions. Have groups collaborate to describe the position of one student relative to the other (e.g., in front of, behind, etc.). Invite groups to share their descriptions and discuss the differences. Help students to recognize that different perspectives result in differently described positions for an object that has not moved!

Aerial View

Project an aerial view of the local community using Google Maps™ and ask students to describe the position of a specific landmark from different perspectives (e.g., other landmarks or locations on the map).

CONSOLIDATE

Where's the Ball?

Take students outside or to the gym and play soccer baseball. Have several students describe the landing position of each kick in relation to the position they are playing (e.g., first base).

Here You Are

Invite students to view a photo of the class arranged on risers or stairs (See Here I Am in the Explore More section of *Describing an Object's Position*.)

and have them describe the position of one specific student relative to several other students in the photo.

Locating Rooms

Challenge students to work in small groups to create simple maps showing the location of the rooms in the school. Then ask students to describe the location of a specific room from the perspective of different classrooms in the school.

EXPLORE MORE

Board Games

Have students view board games and describe the position of a specific game piece from the perspective of the other game pieces. For example, you might randomly place chess pieces on a chessboard. After identifying the particular pieces for students, have them identify the position of the Queen from the perspective of the other game pieces on the board.

Investigating Patterns of Movement



Focus: Students investigate patterns of movement and discover how the forces of push and pull are necessary to initiate movement.

Specific Curriculum Outcomes

Students will be expected to:

- 38.0 investigate different patterns of movement [GCO 1/3]
- 6.0 predict based on an observed pattern [GCO 2]
- 2.0 communicate using scientific terminology [GCO 2]

Performance Indicators

Students who achieve these outcomes will be able to:

- investigate, describe, and represent different patterns of movement
- identify pushes and pulls necessary to initiate movement

NOTES:

Attitude Outcome Statements

Encourage students to:

- work with others in exploring and investigating [GCO 4]
- be open-minded in their explorations [GCO 4]

Cross-Curricular Connections

English Language Arts

Students will be expected to:

- interact with sensitivity and respect, considering the situation, audience, and purpose [GCO 3]
- use writing and other forms of representation to explore, clarify, and reflect on their thoughts, feelings, experiences, and learnings; and to use their imaginations [GCO 8]

Getting Organized

Components	Materials	Before You Begin	Vocabulary
• Science Card 1 (optional) • Science Card 2 (optional) • BLM <i>Sorting Chart</i> • Science Card 7 • IWB Activity 6 • Science Card 8 • Science Card 3 (optional) Literacy Place: • <i>Come to the Pow-wow!</i> (Shared Reading – Synthesizing Strategy Unit)	• students' Science Folders • pull toy • variety of objects from the Curiosity Centre • measuring tools • magnifying lenses • recording materials • students' Science Journals • 2 large dice • digital camera or tablet • old magazines	• Create movement dice by labelling one die with different movements and the second with ways to move (e.g., fast, slow, forward, backward, etc.). • Invite an Elder or an Indigenous Knowledge Keeper to introduce students to traditional Indigenous games involving movement.	• pattern • force • push • pull

Science Background

- In science, the word “force” has a precise meaning. For students at this age, it is appropriate to describe a force as a push or a pull.
- A force is not something that an object contains or ‘has in it.’ A force is exerted on one object by another object.
- Both living and non-living things can exert a force as well as have a force exerted on them.
- Humans and other animals have muscles that produce force allowing them to move. In objects, force is produced by some outside source.
- The way to start an object moving or change how it is moving is to give it a push or a pull.

Possible Misconceptions

- The word “force” has meanings in the everyday lives of students (e.g., forcing someone to do something; the police force; “May the force be with you.”). Reinforce with students that in science, a force is a push or a pull.

- Young students tend to associate pushes and pulls with living things and to a lesser extent with machines that cause motion, such a bulldozer pushing a pile of rocks.
- Many students believe that something that can't be observed or felt by humans (or animals) doesn't exist. It is important to explain that while forces cannot be seen, their effects can.

ACTIVATE



Literacy Place Connection:

Revisit or read *Come to the Pow-wow!* by Wendy A. Lewis. Ask:

- **What patterns are described in the story?** (patterns of beads)

Then ask:

- **What other patterns are described?** (patterns of movement)

Discuss with students how Raven twirls and spins as she dances and then how both girls stomped and twirled. Reinforce that these are patterns of movement.

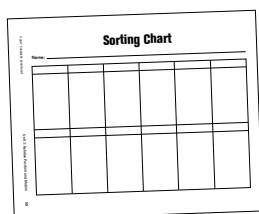


Sorting Objects and Animals

Display Science Cards 1 and 2 and review with students the non-living and living things that move and how they move. Challenge students to sort the objects and/or people and other animals according to how they move. Create a class sorting chart to record the information. Explain that a way of moving is called a pattern of movement. Ask:

- **Do any living and non-living things move in the same way?** (e.g., dice roll and horses roll on the ground.)

rotate: yo-yo top hula hoop girl	swing: swings	bounce: dice bouncy ball with handles ball	slide: hockey puck sleds	roll: in-line skates dice ball horse	fly: paper airplane butterfly
climb: bears	jump/hop: whale kids cat dog boy with crutches	crawl: snail	swim: girl whale	shake: dog	



Have students record the information on their own copy of BLM *Sorting Chart* and then challenge them to add more objects or animals for each category identified. Invite students to share with a partner which objects or animals they added to their charts. Remind students to store their completed BLMs in their Science Folders.

Pushes and Pulls

Place a toy, such as a pull toy, in front of the class and ask:

- **How can we make this object move?**



Try out students' suggestions. Ask them to describe what they are doing to make the object move. Conclude with the students that an object needs a "push" or a "pull" to move. Tell students that a push or pull is called a "force." Add all three terms to the Word Wall. Invite students to add any questions they may have about pushes and pulls to the I Wonder Wall.

CONNECT



How Will It Move?

Display Science Card 7 and have students examine the photos. Ask them to predict how each object may move. Have similar objects, as well as a variety of other objects, in the classroom Curiosity Centre for investigation following the discussion (e.g., wheeled toys, pull toys, spinning tops or yo-yos, pendulums, rubber balls, hockey pucks, marbles, salad spinner, corkscrew, hand mixer, etc.).

In pairs or small groups, have students choose several objects from the Curiosity Centre, make a prediction of how each will move, and investigate how they move. Provide tools for measuring, magnifying lenses, and recording materials. Encourage students to move the objects in unconventional ways. Ask:

- Did the object move in the way you predicted?
- Did the object need a push or a pull?
- How did the objects move similarly or differently from each other?
- How do pushes and pulls make objects move in different ways?



In their Science Journals, students can describe and draw diagrams showing how their objects moved. Ask:

- What else would you like to find out about how or why objects move?



Students can record their questions on the I Wonder Wall.

Movement Dice

Provide 2 large movement dice (one labelled with different movements and the second with ways to move, e.g., fast, slow, forward, backward, 3 times, etc.). Have students take turns rolling both dice and making the movements. Ask students to decide whether each movement is caused by pushing or pulling (e.g., when we walk, our feet are pushing us forward).

Imitating Animal Movements

Invite students to imitate the ways in which animals move and identify where the push or pull occurs that assists the animals in moving (e.g., a bird's wings pushing against the air). Students can take digital photos of their classmates imitating an animal then write a sentence describing the movement (e.g., Vicky slithers like a snake.). Students could then take their photos and sentence and put them in a PicCollage.

IWB Activity:

- Students can use Activity 6: *Push or pull?* (see the Teacher's Website) to identify whether a 'push' or a 'pull' is needed to move each object shown.



CONSOLIDATE

Push and Pull on the Playground

Students can investigate the forces of push and pull using various equipment in the playground, e.g., monkey bars, see-saw, swings, slide, merry-go-round. As they investigate, have students create a video of the playground forces. Ask:

- How is the motion different or the same on each piece of equipment?
- When do you pull? When do you push?
- How do pushes and pulls affect movement?

Display Science Card 8 and have students identify the forces shown for the various pieces of playground equipment on the card. Ask:

- Which image shows a push? A pull?

Have students use sticky notes to label each force shown on the card. Students can record in their Science Journals their understanding of how pushes and pulls affect the motion of objects.

Traditional Games

Invite an Elder or an Indigenous Knowledge Keeper to visit and introduce traditional Indigenous games to the students. Students can discuss the various movements involved in playing the games.

EXPLORE MORE

Identifying Forces

Students can cut out pictures from old magazines or print some pictures from the Internet showing forces being used to move objects. Have students label each force as a push or a pull. Alternatively, students can use sticky notes to label the forces shown at the construction site on Science Card 3.

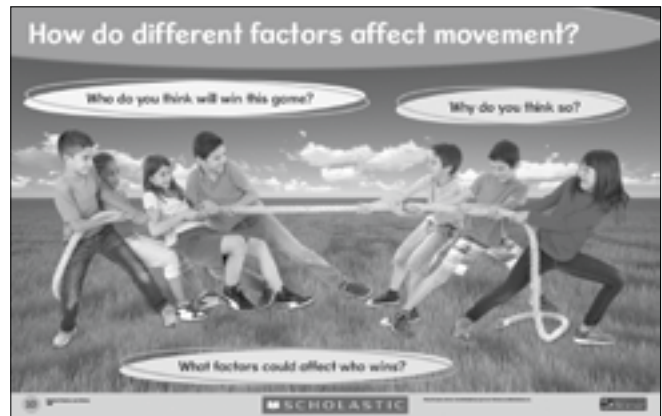
Scavenger Hunt

Students can go on a push and pull scavenger hunt in the classroom or around the school noting in their Science Journals objects that require a push or a pull to move. Students might also take digital images or make a video of the objects in motion. Invite students to tell how our lives would be different if we didn't push or pull these things (e.g., pulling on the door handle lets us open the door and leave the room).

Sorting Chart

Name: _____

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?**

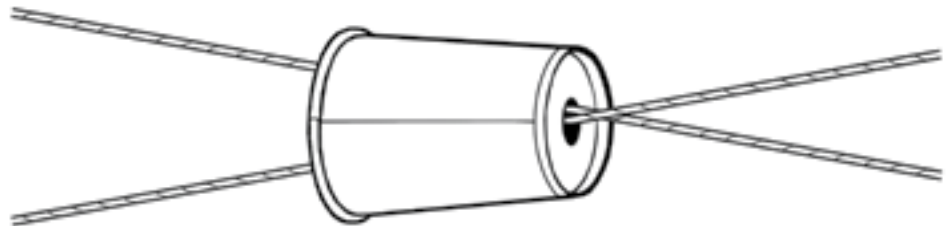
Invite students to roll toy cars over different surfaces such as carpet, the bare floor, and any other surfaces they suggest. Ask:

- **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.

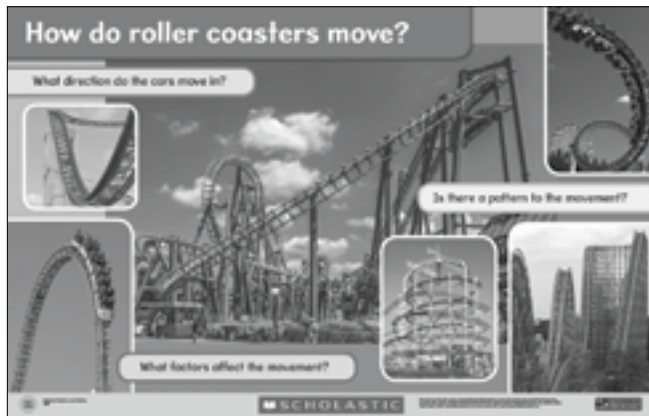
Discuss with students what these objects do for us to make movement easier. Ask how each item helps us and have students identify one surface on which each object helps movement and one surface on which the object would make movement harder.

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.

Design Challenge: Building a Roller Coaster



Focus: Students explore materials and tools then use the design process to build their own 'roller coasters.'

Specific Curriculum Outcomes

Students will be expected to:

- 16.0 use appropriate tools [GCO 2]
- 31.0 respond to the ideas and actions of others and acknowledge their ideas and contributions [GCO 2]
- 32.0 compare and evaluate personally constructed objects [GCO 2]

Performance Indicators

Students who achieve these outcomes will be able to:

- use appropriate tools and materials to create a roller coaster that meets specified design criteria

NOTES:

Attitude Outcome Statements

Encourage students to:

- show concern for their safety and that of others in carrying out activities and using materials [GCO 4]

Cross-Curricular Connections

English Language Arts

Students will be expected to:

- interact with sensitivity and respect, considering the situation, audience, and purpose [GCO 3]
- use writing and other forms of representation to explore, clarify, and reflect on their thoughts, feelings, experiences, and learnings; and to use their imaginations [GCO 8]

Getting Organized

Components	Materials	Before You Begin	Vocabulary
• Science Card 11 • <i>What Is the Design Process?</i> poster • Science Card 12 • IWB Activity 9 • BLM <i>Two Stars and a Wish</i>	• selection of commercially produced games such as Mouse Trap, Hot Wheels Racetrack, or a marble maze • large variety of building materials and tools such as cardboard rolls; PVC pipe; pool noodles; Hot Wheels tracks; funnels; craft sticks; paper, aluminum, or Styrofoam plates; socks; duct, packing, or masking tape; glue; staples; string; shoelaces; ribbon; paper clips; paper fasteners; clothespins; Playdough; Sticky Tack; pipe cleaners; plastic, twist, or cable ties; wire • marbles, Ping-Pong balls, or golf balls • students' Science Journals • tablets (optional)	• Find and bookmark online video clips of roller coasters and/or similar amusement park rides. See <i>Additional Resources</i> on page 59 for possible Websites.	• direction • pattern

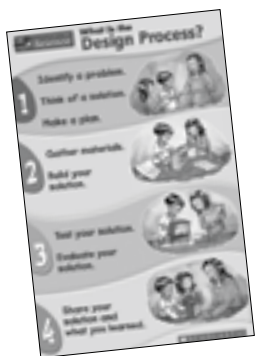
Science Background

- A roller coaster car is pulled to the top of the first hill (the tallest hill in the entire ride) and then it is released. The force of gravity makes the car hurtle downwards and the car continues to roll along the track without any external mechanical assistance for the remainder of the ride. The up and down motions of the ride keep the cars moving (using potential and kinetic energy) but eventually the forces of friction and air resistance ensure the car gradually slows down. A brake on the track brings the car to a complete and safe stop.

Possible Misconceptions

- Students may think roller coasters have an engine, like a car, to keep it racing around the track. Explain to students that it's the up and down motions that keep the roller coaster cars moving.

ACTIVATE



Features of Roller Coasters

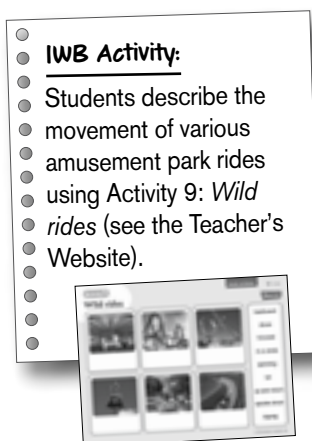
Display Science Card 11 and discuss with students the various features of roller coasters. You might also share online video clips of roller coasters and other similar amusement park rides with the students. Ask:

- How do these rides move?
- What direction do they move in?
- Is there a pattern to the movement?
- What factors affect the movement?

Tell students that they will be working in small groups to design and build their own roller coasters. With the students, establish the specific criteria for their challenge, for example, the roller coaster should move a marble at least 4–6 different ways (up, down, left, right, side-to-side, in a circle, etc.).

Review the *What Is the Design Process?* poster with students and clarify the necessary steps in the process including making a plan, selecting materials and tools, building a prototype, testing it, as well as evaluating and revising their prototype as necessary.

CONNECT



Simple Models

Provide commercially produced games, such as Mouse Trap, Hot Wheels Racetrack, or a marble maze. Encourage students to explore the games and build simple models that can move a marble in different ways. Ask:

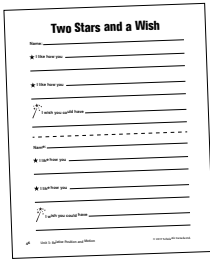
- How are these games similar to the roller coasters shown on Science Card 11?
- What materials could you use to build your own roller coasters?

Exploring Materials and Tools

Share Science Card 12 with the students and discuss the various materials and tools shown. Ask how students think these and/or other materials might be used to create a roller coaster.

Provide a wide variety of materials and tools for students to explore. Invite students to test the materials and tools by conducting trials, and to discuss the pros and cons with their group members to help them choose appropriate tools and materials for building their roller coaster.

CONSOLIDATE



Build It!

Have the groups record their plans and ongoing construction in their Science Journals or by making photo journals on a tablet or other technology. Students may also choose to record their conversations which could help them to communicate their procedure when they present their final roller coaster to the class.

Have students do a Gallery Walk to examine other groups' prototypes. Encourage them to give constructive criticism to other groups using BLM *Two Stars and a Wish*, and to take notes on any ideas they want to incorporate into their own design.

Groups can then finalize their design and test their roller coaster. They should evaluate their design based on the results of their test, and redesign as necessary.

Groups can demonstrate their roller coaster to the class and explain how their prototype meets the established criteria for the design challenge. Encourage students to explain how the roller coaster moves. They might also share some of the challenges they faced in designing and building their roller coasters.

EXPLORE MORE



New Ideas

Students can identify future suggestions or implementations for their roller coasters in their Science Journals. Encourage them to include sketches or diagrams of any proposed changes.

WRAPPING UP THE UNIT



Revisit the questions posted on the I Wonder Wall and have students discuss answers in small groups or with a partner. If there are questions which cannot be answered at the time, these can remain on the I Wonder Wall for students to research independently. Discuss what the students have learned about relative position and motion.

Two Stars and a Wish

Name: _____

★ I like how you _____

★ I like how you _____



I wish you could have _____

Name: _____

★ I like how you _____

★ I like how you _____



I wish you could have _____

Specific Curriculum Outcomes Checklist

Name: _____ Date: _____

Rating: 1 – not evident; 2 – with assistance; 3 – mostly on own; 4 – on own consistently

Specific Curriculum Outcomes	Rating and Observations
33.0 describe the motion of an object in terms of a change in position relative to other objects [GCO 1/3]	
34.0 describe the position of an object relative to other positions or stationary objects [GCO 1/3]	
35.0 place an object in an identified position relative to another object or position [GCO 1/3]	
36.0 follow a simple procedure [GCO 2]	
37.0 describe the position of objects from different perspectives [GCO 1/3]	
38.0 investigate different patterns of movement [GCO 1/3]	
39.0 investigate factors that affect movement [GCO 1/3]	
40.0 pose new questions that arise from what was learned [GCO 2]	
1.0 pose questions that lead to exploration and investigation [GCO 2]	
2.0 communicate using scientific terminology [GCO 2]	
6.0 predict based on an observed pattern [GCO 2]	
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]	
16.0 use appropriate tools [GCO 2]	
27.0 identify problems to be solved [GCO 2]	
31.0 respond to the ideas and actions of others and acknowledge their ideas and contributions [GCO 2]	
32.0 compare and evaluate personally constructed objects [GCO 2]	

My Inquiry

Name: _____

My question:

My plan:

My results:

My conclusion:

How I will share what I learned:

Student Self-Assessment of Inquiry Process

Name: _____

Rating Scale  = Great  = Good  = Needs to be better

Step 1			
I asked a question.			
I made a plan.			
Step 2			
I followed my plan.			
I recorded my results.			
Step 3			
I thought about my results.			
I made a conclusion.			
Step 4			
I shared what I learned.			

Teacher Assessment of Inquiry Process

Name: _____ Date: _____

	1	2	3	4
Initiating and Planning				
• poses a question that leads to exploration or investigation				
• makes a prediction based on an observed pattern				
• makes a simple plan				
• selects and uses materials				
Performing and Recording				
• carries out the plan/follows a simple procedure				
• uses appropriate tools				
• makes observations				
• records observations and measurements				
• identifies and uses a variety of sources of information and ideas				
• follows safety procedures and rules				
Analyzing and Interpreting				
• sequences or groups materials and objects				
• constructs and labels concrete-object graphs or pictographs				
• proposes an answer to the initial question and draws a simple conclusion				
• poses new questions that arise from what was learned				
Communicating and Teamwork				
• communicates while exploring and investigating				
• communicates using scientific terminology				
• communicates procedure and result				
• responds to ideas and actions of others and acknowledges their ideas and contributions				

Comments:

Inquiry Process Rubric

	Level 1	Level 2	Level 3	Level 4
INITIATING AND PLANNING	talks about things that are of interest makes guesses about the outcome of an inquiry with prompting, offers ideas for a procedure with prompting, identifies some materials which could be used to carry out the plan	asks simple questions about objects and events that are observable makes simple predictions about the outcome of an inquiry, but they may be hoped-for outcomes contributes ideas for a procedure but they may not be complete identifies some materials which could be used to carry out the plan	uses observations to ask questions to investigate, but questions are not always realistic makes simple predictions about the outcome of an inquiry based on prior observations provides ideas for a simple procedure selects and uses materials to carry out the plan	uses observations and prior knowledge to ask questions to investigate makes thoughtful predictions about the outcome of an inquiry based on prior observations and knowledge provides clear, sequential steps for a simple procedure selects and uses appropriate materials to carry out the plan and explains reasons for choice
PERFORMING AND RECORDING	carries out the plan/ follows a simple procedure with prompting with prompting, uses some appropriate tools with assistance makes simple observations using senses with prompting, records observations and measurements gets information from a teacher-chosen source needs help to follow safety procedures and rules	carries out the plan/ follows most of a simple procedure selects and uses common tools makes some relevant observations using senses records observations and measurements which may be incomplete identifies some relevant information from familiar sources needs occasional prompting to follow safety procedures and rules	carries out the plan/follows a simple procedure selects and uses some appropriate tools makes relevant observations using appropriate senses records observations and measurements accurately identifies relevant information from sources of the same type follows most safety procedures and rules	carries out the plan/ follows a simple procedure, making adjustments as necessary selects and uses all appropriate tools makes relevant, detailed observations using appropriate senses records observations and measurements accurately in a variety of ways identifies relevant information from a variety of sources follows all safety procedures and rules and explains why they are needed

Continued on next page...

Inquiry Process Rubric (Continued)

	Level 1	Level 2	Level 3	Level 4
ANALYZING AND INTERPRETING	sequences or groups materials and objects based on simple teacher-chosen attributes with prompting, constructs a concrete-object graph or pictograph describes what happened with prompting, identifies some new questions but they may not be about this inquiry	sequences or groups materials and objects based on a few simple attributes constructs a concrete-object graph or pictograph but title and labels may be missing or inappropriate draws a simple conclusion based on observations but may not link conclusion to the initial question identifies some simple new questions on the topic of this inquiry	sequences or groups materials and objects based on multiple attributes constructs a concrete-object graph or pictograph with appropriate title and labels draws a conclusion based on observations which link to the initial question identifies some new questions on the topic of this inquiry that could be investigated	accurately sequences or groups materials and objects based on multiple attributes constructs a concrete-object graph or pictograph with appropriate title and labels to accurately reflect results draws a conclusion based on observations and states if it supports or refutes their prediction identifies new questions on the topic of this inquiry and suggests how they could be investigated
COMMUNICATING AND TEAMWORK	willingly asks for help and accepts help from other group members understands some scientific terminology but rarely uses it with prompting, describes the result and some of the procedures listens to others and learns from their observations	makes suggestions to group members as to what should be done understands simple scientific terminology but does not always use it correctly communicates basic information about the result and most of the procedures listens to others and learns from their observations, and draws on their language use	communicates with group members, sometimes with problems usually uses scientific terminology appropriately communicates most of the information about the result and procedures considers and responds to the ideas of others and learns from their observations and descriptions	communicates and works effectively with group members consistently uses scientific terminology appropriately accurately communicates the information about the result and procedures considers and responds to the ideas of others and applies the observations and descriptions to their own ideas and understandings

My Design

Name: _____

The problem:

My solution and my plan:

How I will test my solution:

How my solution worked:

How I will share my solution and what I learned:

Student Self-Assessment of Design Process

Name: _____

Rating Scale  = Great  = Good  = Needs to be better

Step 1			
I identified the problem.			
I chose a solution and made a plan.			
Step 2			
I built my solution.			
Step 3			
I tested my solution.			
I evaluated my solution.			
Step 4			
I shared my solution and what I learned.			

Teacher Assessment of Design Process

Name: _____ Date: _____

	1	2	3	4
Initiating and Planning				
• identifies a problem to be solved				
• thinks of a possible solution to the problem and makes a simple plan				
• selects and uses materials				
Performing and Recording				
• carries out the plan/follows a simple procedure				
• uses appropriate tools				
• makes and records observations and measurements				
• constructs a prototype				
• follows safety procedures and rules				
Analyzing and Interpreting				
• proposes an answer to the initial problem				
• compares and evaluates personally-constructed objects				
• poses new questions that arise from what was learned				
Communicating and Teamwork				
• communicates while exploring and investigating				
• communicates using scientific terminology				
• communicates the procedure and result				
• responds to ideas and actions of others and acknowledges their ideas and contributions				

Comments:

Design Process Rubric

	Level 1	Level 2	Level 3	Level 4
INITIATING AND PLANNING	works on a problem set by the teacher or group suggests a solution to the problem and, with prompting, offers ideas about procedure with prompting, identifies some materials which could be used to carry out the plan	identifies a problem to solve but it may not be practical suggests a solution to the problem and makes a simple plan identifies some materials which could be used to carry out the plan	identifies a practical problem to solve suggests several possible solutions to the problem and chooses one; makes a simple plan selects and uses appropriate materials to carry out the plan	identifies a practical problem to solve and gives some criteria for solving it suggests several possible solutions to the problem that address the criteria; chooses the best solution and makes a simple plan selects and uses appropriate materials to carry out the plan and explains reasons for choice
PERFORMING AND RECORDING	with prompting, carries out the plan/follows a simple procedure with prompting, uses some appropriate tools with assistance makes simple observations using senses; with prompting, records observations and measurements constructs a prototype but does not follow the plan needs help to follow safety procedures and rules	carries out the plan/follows most of a simple procedure selects and uses common tools makes some relevant observations using senses; records observations and measurements which may be incomplete constructs a prototype according to the plan but the device may not be useable needs occasional prompting to follow safety procedures and rules	carries out the plan/follows a simple procedure selects and uses some appropriate tools makes relevant observations using appropriate senses; records observations and measurements accurately constructs a usable prototype according to the plan follows most safety procedures and rules	carries out the plan/follows a simple procedure, making adjustments as necessary selects and uses all appropriate tools makes relevant, detailed observations using appropriate senses; records observations and measurements accurately in a variety of ways constructs a usable prototype according to the plan with modifications for improvement follows all safety procedures and rules and explains why they are needed

Design Process Rubric (Continued)

	Level 1	Level 2	Level 3	Level 4
ANALYZING AND INTERPRETING	with prompting, says whether or not a solution works with prompting, makes simple suggestions for changes to improve the device/solution with prompting, identifies some new questions but they may not be on the same topic	says whether a solution works in terms of some simple criteria suggests some practical changes to improve the device/solution identifies some new questions on the same topic	evaluates and explains the effectiveness of a solution in terms of simple criteria suggests and makes practical changes to improve the device/solution identifies some new questions that arise from the solution	evaluates and explains the effectiveness of a solution in terms of a broad range of criteria makes effective changes to improve the device/solution identifies new questions that arise from the solution and suggests how they could be solved
COMMUNICATING AND TEAMWORK	willingly asks for help and accepts help from other group members understands some scientific terminology but rarely uses it with prompting, describes the solution and some of the procedures listens to others and learns from their observations	makes suggestions to group members as to what should be done understands simple scientific terminology but does not always use it correctly communicates basic information about the solution and most of the procedures listens to others and learns from their observations, and draws on their language use	communicates with group members, sometimes with problems usually uses scientific terminology appropriately communicates most of the information about the solution and procedures considers and responds to the ideas of others and learns from their observations and descriptions	communicates and works effectively with group members consistently uses scientific terminology appropriately accurately communicates the information about the solution and procedures considers and responds to the ideas of others and applies the observations and descriptions to their own ideas and understandings

Additional Resources

Non-fiction Books

- Circular Movement*, by Lola M. Schaefer (Pebble Books, 2001)
- Forces Make Things Move*, by Kimberly Brubaker Bradley (HarperCollins, 2005)
- How Animals Move*, by Peter Riley (Franklin Watts Ltd., 2008)
- Motion: Push and Pull, Fast and Slow*, by Darlene R. Stille (Capstone Press, 2005)
- Move It!: Motion, Forces, and You*, by Adrienne Mason (Kids Can Press, 2005)
- Push and Pull*, by Lola M. Schaefer (Pebble Books, 2001)
- Newton and Me*, by Lynne Mayer (Sylvan Dell Publishing, 2010)
- Tell Me How Fast It Goes (Whiz Kids)*, by Shirley Willis (Book House, 2002)
- What Is Friction?*, by Lisa Trumbauer (Children's Press, 2004)
- Zigzag Movement*, by Lola M. Schaefer (Pebble Books, 2001)

Picture Books

- And Everyone Shouted, "Pull!"*, by Claire Llewellyn (Picture Window Books, 2004)
- Move!*, by Steve Jenkins and Robin Page (HMH Books for Young Readers, 2006)
- Oscar and the Cricket: A Book About Moving and Rolling*, by Geoff Waring (Candlewick, 2009)
- Push It, Pull It*, by Claire Llewellyn (Wayland Publishers, 2009)
- Roller Coaster*, by Marla Frazee (HMH Books for Young Readers, 2006)
- This is the Way*, by Charles Fuge (Gullane Children's Books, 2008)
- Zoom!*, by Diane Adams (Peachtree Publishers, 2005)

Websites for Students

- BBC: School Science Clips – Pushes and Pulls
http://www.bbc.co.uk/schools/scienceclips/ages/5_6/pushes_pulls.shtml
- BBC: School Science Clips – Forces and Movement
http://www.bbc.co.uk/schools/scienceclips/ages/6_7/forces_movement.shtml
- BBC: School Science Clips – Friction
http://www.bbc.co.uk/schools/scienceclips/ages/8_9/friction.shtml
- Bill Nye the Science Guy – Force and Motion
<http://www.youtube.com/watch?v=8iKhLGK7HGk>
- Learning Games for Kids – Friction Ramp Game
<http://www.learninggamesforkids.com/motion-games/friction-ramp.html>
- Learning Games for Kids – Map Game
<http://www.learninggamesforkids.com/motion-games/map-it.html>
- Learning Games for Kids – Motion Song
<http://www.learninggamesforkids.com/motion-games/motion-song-3.html>

**Websites
for Teachers**

Sid the Science Kid – Friction Game
<http://www.pbskids.org/sid/funwithfriction.html>

TVO Kids – Friction
<http://www.tvokids.com/videos/friction>

Helpful Technology Videos:

7 Crazy Bicycles
<https://www.youtube.com/watch?v=fGS2SgiLG80>

10 Most Amazing Vehicles
<https://www.youtube.com/watch?v=P5FvarVt3us>

Different Types of Skateboards
<https://www.youtube.com/watch?v=uXoF8hwlGXk>

Futuristic Shoe Inventions
https://www.youtube.com/watch?v=xNUV7_7qbKQ

How to Choose the Right Snowboard
<https://www.youtube.com/watch?v=rPkQriyuJGk>

Sporting Event Videos:

Olympic Sports Videos
<https://www.olympic.org/videos>

Roller Coaster Videos:

Sky Scream Roller Coaster
https://www.youtube.com/watch?v=h_lcZcBcQ0o

Top 7 Roller Coasters of 2016
<https://www.youtube.com/watch?v=Di8FjtFifrA>

Dear parents and caregivers,

We are about to start a new unit in science where we will be exploring relative position and motion. Through a variety of hands-on explorations and investigations, your child will be learning about the different ways that objects and living things move, forces that affect movement, as well as how to describe the position and motion of objects.

You can talk to your child at home about relative position and motion:

- Challenge your child to describe the location of specific objects using positional language (e.g., the shelf is above the light switch that is on the wall next to the door).
- Play a game of “Simon Says” to explore movement (e.g., Simon says to spin around; Simon says to hop on one foot). Take turns with your child in giving and following directions.
- Create a treasure map and invite your child to locate objects using the map.

To ensure a wide range of experiences and make connections between this topic and your child’s world, he/she may choose to bring one or more personal items to school for exploration during in-class activities. These items will be returned home once explorations are completed. To determine whether the item(s) is appropriate please contact me, your child’s teacher.

Sincerely,