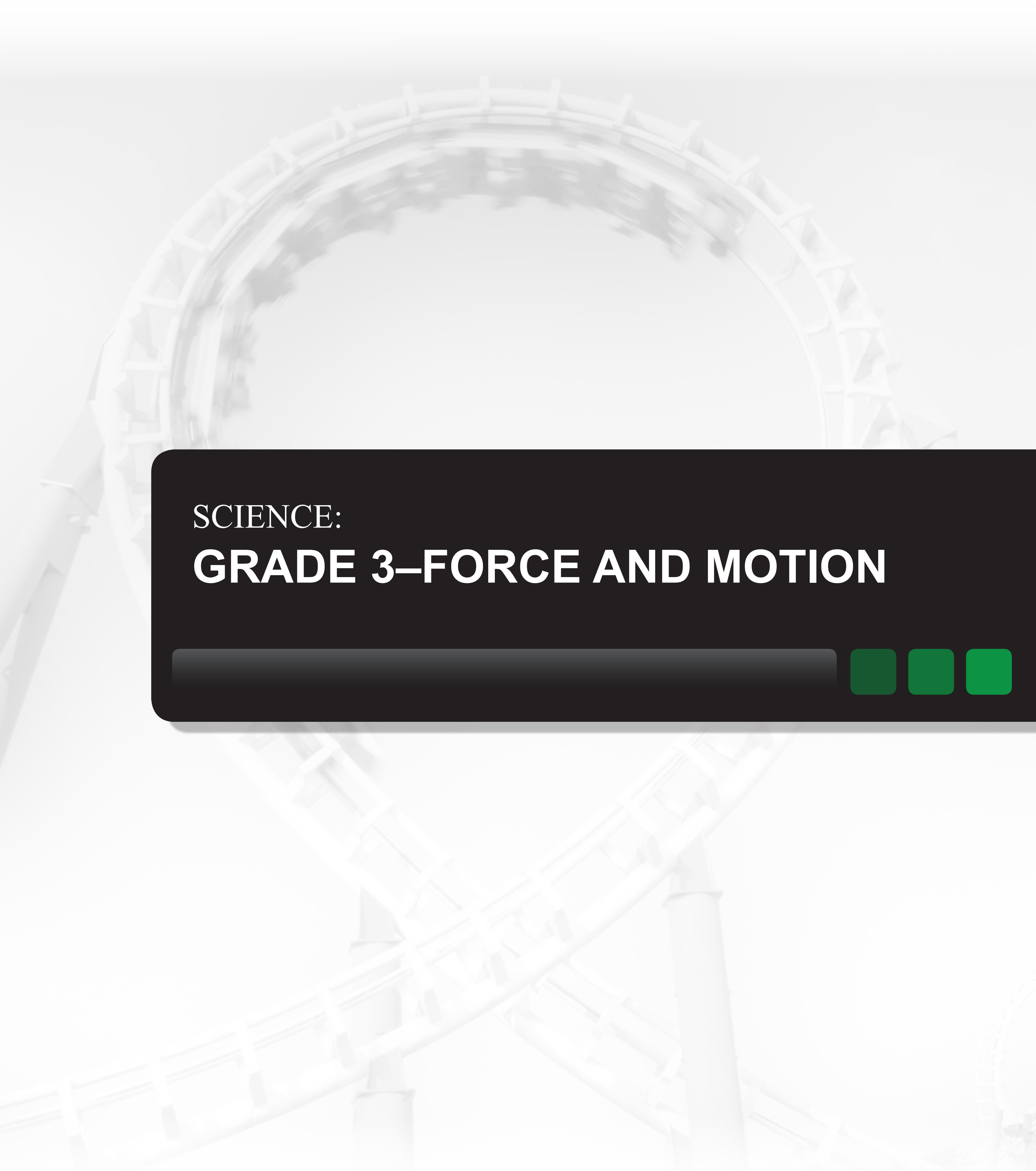


SCIENCE:

GRADE 3–FORCE AND MOTION

GRADE 3

Force and Motion

Forces at Work

TEKS

3 (6) **Force, motion, and energy. The student knows that forces cause change and that energy exists in many forms.**

(B) The student is expected to demonstrate and observe how position and motion can be changed by pushing and pulling objects to show work being done such as swings, balls, pulleys, and wagons.

(C) The student is expected to observe forces such as magnetism and gravity acting on objects.

Content Objective

I can demonstrate how pushing and pulling forces change an object's motion or position.
I can show work being done with and without simple machines.

Science

Science Process Skills

3 (2) **Scientific investigation and reasoning. The student uses scientific inquiry methods during laboratory and outdoor investigations.**

(B) The student is expected to collect data by observing and measuring using the metric system and recognize differences between observed and measured data.

(E) The student is expected to demonstrate that repeated investigations may increase the reliability of results.

(F) The student is expected to communicate valid conclusions supported by data in writing, by drawing pictures, and through verbal discussion.

3 (4) **Scientific investigation and reasoning. The student knows how to use a variety of tools and methods to conduct science inquiry.**

(A) The student is expected to collect, record, and analyze information using tools, including microscopes, cameras, computers, hand lenses, metric rulers, Celsius thermometers, wind vanes, rain gauges, pan balances, graduated cylinders, beakers, spring scales, hot plates, meter sticks, compasses, magnets, collecting nets, notebooks, sound recorders, and Sun, Earth, and Moon system models; timing devices, including clocks and stopwatches; and materials to support observation of habitats of organisms such as terrariums and aquariums.

Mathematics

3 (11) **Measurement. The student directly compares the attributes of length, area, weight/mass, and capacity, and uses comparative language to solve problems and answer questions. The student selects and uses standard units to describe length, area, capacity/volume, and weight/mass.**

(A) The student is expected to use linear measurement tools to estimate and measure lengths using standard units.

3 (16) **Underlying processes and mathematical tools. The student uses logical reasoning.**

(A) The student is expected to make generalizations from patterns or sets of examples and nonexamples.

English Language Arts and Reading

3 (29) **Listening and speaking/listening. Students use comprehension skills to listen attentively to others in formal and informal settings. Students continue to apply earlier standards with greater complexity.**

(A) Students are expected to listen attentively to speakers, ask relevant questions, and make pertinent comments.

3 (30) **Listening and speaking/speaking. Students speak clearly and to the point, using the conventions of language. Students continue to apply earlier standards with greater complexity. Students are expected to speak coherently about the topic under discussion, employing eye contact, speaking rate, volume, enunciation, and the conventions of language to communicate ideas effectively.**

3 (31) **Listening and speaking/teamwork. Students work productively with others in teams. Students continue to apply earlier standards with greater complexity. Students are expected to participate in teacher- and student-led discussions by posing and answering questions with appropriate detail and by providing suggestions that build upon the ideas of others.**

Force and Motion

Figure 19.

Reading/comprehension skills. Students use a flexible range of metacognitive reading skills in both assigned and independent reading to understand an author's message. Students will continue to apply earlier standards with greater depth in increasingly more complex texts as they become self-directed, critical readers.

(C) The student is expected to monitor and adjust comprehension (e.g., using background knowledge, creating sensory images, re-reading a portion aloud, generating questions).

(D) The student is expected to make inferences about text and use textual evidence to support understanding.

English Language Proficiency Standards

1 (E) Cross-curricular second language acquisition/learning strategies. The student is expected to internalize new basic and academic language by using and reusing it in meaningful ways in speaking and writing activities that build concept and language attainment.

2 (D) Cross-curricular second language acquisition/listening. The student is expected to monitor understanding of spoken language during classroom instruction and interactions and seek clarification as needed.

3 (E) Cross-curricular second language acquisition/speaking. The student is expected to share information in cooperative learning interactions.

Language Objective

I can use the words force, magnetism, *and* gravity *when speaking and writing.*

Response to Intervention/Tier 1 Differentiation

All science lessons support students in receiving quality Tier 1 instruction. Using the 5E model, knowledge is taught in a variety of contexts, integrating math, science, and ELA content, thus supporting the active engagement of students with the content. Lesson-specific differentiation strategies for addressing diverse student needs can be found throughout each lesson in sections titled "Differentiation Strategy."

Force and Motion

Differentiation should

- focus on skills students did not understand and extend the lesson for advanced students;
- be conducted in small groups or embedded in whole-group instruction; and
- provide students with a variety of strategies to process the information, such as
    - allowing for additional opportunities for verbal brainstorming of words associated with a topic (with teacher taking dictation);
    - making clear connections of new and more complex concepts to foundational aspects and prior knowledge;
    - participating in more tangible experiences, such as experiments, investigations, and active exploration;
    - sorting academic vocabulary words into categories by common attributes—process words or science content vocabulary;
    - organizing brainstorming into semantic maps or creating graphic organizers;
    - discussing the meaning of a graphic organizer with a partner; and
    - creating a visual representation to demonstrate understanding.

See the handout in the Content Resources section that addresses instructional strategies.

College and Career Readiness Standards

I.A4 Cognitive skills in science. Rely on reproducible observations of empirical evidence when constructing, analyzing, and evaluating explanations of natural events and processes.

Vocabulary Focus
demonstrate
force
gravity
magnetism
motion
object
observe
position
work

GRADE 3

Force and Motion

Prerequisite Science Knowledge

K (6)(B) The student is expected to explore interactions between magnets and various materials.

1 (6)(B) The student is expected to predict and describe how a magnet can be used to push or pull an object.

2 (6)(B) The student is expected to observe and identify how magnets are used in everyday life.

5E Lesson Summary

Engage
Students observe the effects of magnetism and gravity.

Explore
Students demonstrate examples and nonexamples of work.

Explain
Students explain different forces and how pushing and pulling an object can show work being done.

Elaborate
Students observe force and demonstrate work with and without the use of simple machines.

Evaluate
Students observe pictures and assess whether forces and simple machines are being used and whether work is being done.

Engage

Teacher Note

Magnetic wands can be purchased from science material suppliers or teacher supply stores.

Advance Preparation

Cut a piece of string 20 cm long for each student group. Tie a paper clip to one end of each piece of string.

Teacher Instruction

- Pass a piece of string with a paper clip tied to one end and a piece of tape to each student group.
- Instruct students to tape the end of the string not attached to the paper clip to a desk or tabletop.
- Ask the following: Can you make the paper clip float in the air without anything touching it?
- Inform students that they may use the magnetic wand to complete the activity.

Materials

For student groups

- string, 20 cm long, with small paper clip tied to one end
- piece of tape
- magnetic wand

Facilitation Questions

- Were you able to make the paper clip float in the air without anything touching it? *Yes, we were able to make the paper clip float in the air without anything touching it.*
- How did you make the paper clip float? *We made the paper clip float with a magnetic wand. The paper clip rose up off the desk when the magnetic wand came close to it. When we raised the magnetic wand, the paper clip followed it.*
- What force caused the paper clip to float? *The force of magnetism caused the paper clip to float.*

Teacher Instruction

- Ask the following: What happened to the paper clip when you pulled the magnetic wand away from it? Why?

Force and Motion

- Implement the Think-Pair-Share strategy by first instructing students to silently think about an answer to the question. Then have students share their thoughts with a partner. Lastly, have the pairs share their thoughts with the class. *Possible answers may include the following: The paper clip fell to the desk when we pulled the magnetic wand away because the force of magnetism decreased. Students may or may not know that the force of gravity also plays a role in why the paper clip fell to the desk.*

Explore

Teacher Note

The facilitation questions for this section will serve as an answer key for the first four columns on *RM 1: Forces at Work.* The "Push" and "Pull" columns focus on the force that causes the objects to move.

Students will leave the column labeled "Work" blank for now. That column will be referred back to during Explain. The answers to *RM 1* will be addressed in the facilitation questions. Students may not understand the concept of gravity. It will be defined in the Explain portion of the lesson.

Teacher Instruction

- Divide the class into groups of three students.
- Instruct student groups to perform each of the activities on *RM 1*. Students should mark an *X* in the table to indicate a pushing or pulling force and a force of gravity or magnetism, if either applies.
- Remind students to leave the "Work" column blank for now.

Facilitation Questions

- Is rolling a ball a pushing or a pulling force? Why? *Rolling a ball is a pushing force because the ball moves away from us.*
- Did the forces of magnetism and gravity affect the rolling ball? If so, how? *The force of gravity kept the ball on the ground. Magnetism did not affect the ball.*
- Is pressing on a wall a pushing or a pulling force? Why? *Pressing on a wall is a pushing force because we are trying to push something away from us.*
- Did the forces of magnetism and gravity affect the wall? If so, how? *Gravity helps keep the wall on the ground. Magnetism did not affect the wall.*
- Is scooting your chair back from your desk a pushing or a pulling force? Why? *Scooting our chairs back is a pushing force because we are moving our chairs away from our desks.*

Materials

For each student

- RM 1

For student groups

- ball
- 2 magnets
- shoe box
- 1 unopened bottle of water

Download Grade3_ Explore_F&M from Drop Boxes in your Science Academies for Grades K–4 Project Share group to use on a SMART™ or Mimio® interactive whiteboard.

Force and Motion

- Did the forces of magnetism and gravity affect your chair? If so, how? *The force of gravity kept the chair on the ground, making it easier to scoot it back. The force of magnetism did not affect the chair.*
- Is feeling magnets repel a pushing or a pulling force? Why? *Feeling magnets repel is a pushing force because they are pushing away from each other.*
- Did the forces of magnetism and gravity affect the magnets? If so, how? *The force of magnetism caused the magnets to repel when like magnetic poles were facing each other. The force of gravity kept the magnets on Earth's surface.*
- Is dropping a ball a pushing or a pulling force? Why? *Dropping a ball is a pulling force because gravity is pulling the ball toward the ground.*
- Did the forces of magnetism and gravity affect the ball? If so, how? *The force of gravity pulled the ball toward the ground. The force of magnetism did not affect the ball.*
- Is pressing on a table or the teacher's desk using only your pinkie finger a pushing or a pulling force? Why? *Pressing on a table or the teacher's desk is a pushing force because we are trying to move the desk away from us. Students may or may not know that gravity is a pulling force acting on the table or the teacher's desk.*
- Did the forces of magnetism and gravity affect the table or desk? If so, how? *The force of gravity kept the desk on the floor. The force of magnetism did not affect the desk.*
- Is lifting a box from the floor to a tabletop a pushing or a pulling force? Why? *Lifting a box from the floor to a tabletop is a pulling force because we pulled the box away from the floor.*
- Did the forces of magnetism and gravity affect the box? If so, how? *The force of gravity pulled the box toward the floor. The force of magnetism did not affect the box*
- Is raising a water bottle a pushing or a pulling force? Why? *Raising a water bottle can be a pulling force if we are raising the bottle from the floor to a tabletop. Raising a bottle can be a pushing force if we are raising it above our heads.*

- Did the forces of magnetism and gravity affect the water bottle? If so, how? *The force of gravity pulled downward on the water bottle, which made it harder to pull the bottle up. The force of magnetism did not affect the water bottle.*

Force and Motion

Materials

For teacher

- *Forces at Work* book

For each student

- RM 1 from Explore
- *Forces at Work* book

Explain

Teacher Note

The book for this lesson is content heavy. It may be best to read one section at a time and stop often for discussion and reflection. Allow students time to ask questions or discuss the concepts in the book with a classmate.

Teacher Instruction

- Read and discuss *Forces at Work*.

Facilitation Questions

- What is a force and what are some examples of force? *A force is a push or a pull. Some examples of force are magnetism and gravity.*
- What happens when you put two magnets together with both like poles facing each other? *Magnets with two north or two south poles facing each other will repel, or push away from, each other.*
- What happens when you put two magnets together with different poles facing each other? *Magnets with two different poles facing each other will attract, or pull together.*
- Is everything magnetic, or attracted to magnets? *No, not everything is attracted to magnets.*
- What are some examples of things that are not attracted to magnets? *Glass, plastic, and wood are not attracted to magnets.*
- List some things that are magnetic, or attracted to magnets. *Iron nails and paper clips are attracted to magnets.*
- What is gravity? *Gravity is a pulling force.*
- Why did the paper clip fall to the desk when the magnet was pulled away in the Engage activity? *The paper clip fell to the desk because gravity pulled it down.*
- What determines how strong gravity pulls? *The amount of mass an object has determines how much gravitational pull the object possesses.*

- What happens if we drop a pencil? Why? *The pencil falls to Earth because Earth has a huge mass; therefore, it has a very strong gravitational pull.*
- How do we measure force? *We measure force with a tool called a spring scale.*
- With what metric unit do we measure force? *We use the metric unit of newtons to measure force.*
- What does work mean in science? *Work means we have used force to move an object to a new location.*
- What is an example of work? How do you know? *An example of work is kicking a soccer ball because the kicker uses a pushing force to move the ball to a new location.*
- What are some nonexamples of work? How do you know? *Trying to pull a large tree from the ground is not work because the tree does not move.*
- What is a simple machine? *A simple machine is a tool that makes work easier.*
- What are some examples of simple machines? *Wheels and axles and pulleys are examples of simple machines.*
- How could you use tools that have wheels and axles? *We use wagons, bicycles, cars, and wheelbarrows to move or carry objects from place to place.*
- How could you use pulleys? *We could use pulleys to raise flags up flagpoles.*

Teacher Instruction

- Instruct students to refer back to the activities they performed in the Explore portion of the lesson.
- Help students determine whether work occurred as a result of each activity based on the definitions in the story.
- Mark an *X* in the “Work” column if work is demonstrated in an activity.

Force and Motion

Facilitation Questions

- In which of the activities did work occur? How do you know? *Work occurred when we rolled a ball, dropped a ball, lifted a box, scooted our chairs back, raised the water bottle and felt magnets repel. In each of these activities, an object was moved from one place to another.*
- In which of the activities did work not occur? How do you know? *Work did not occur when we pressed on the wall and used our pinkie fingers to press on a table or the teacher's desk because the wall and the desk or table did not move.*
- Would it be possible to measure the strength of pushing or pulling forces in any of these activities? If so, how? *We could measure how much force is needed to lift a box and raise a water bottle by using a spring scale.*

Force and Motion

RM 1 Answer Key

Activity	Forces: Push	Forces: Pull	Forces: Magnetism	Forces: Gravity	Work
Roll a ball.	X			X	X
Press on a wall.	X			X	
Scoot your chair back.	X			X	X
Feel magnets repel.	X		X	X	X
Drop a ball.		X		X	X
Press on a table or the teacher's desk using only your pinkie finger.	X			X	
Lift a box from the floor to a tabletop.		X		X	X
Raise an unopened water bottle.		X		X	X

GRADE 3

Force and Motion

Elaborate, Part 1

Materials

For teacher

- scissors or box cutter

For each student

- RM 4

For student groups

- RM 2
- shoe box
- nylon rope, 3/16” thick, 20 cm long
- 4 CDs
- 4 CD wheel spacers, 5/8” diameter with 3/16” center diameter
- 2 dowel rods, 3/16” diameter, 12” long
- masking tape
- marker
- meter stick
- push-pull spring scale, 5 N maximum

Teacher Note

Push-pull spring scales that measure force in newtons can be purchased from science material suppliers. CD wheel spacers are small, circular plastic or rubber pieces that snap into the center hole of a CD. They can be purchased online through hobby stores.

Content Builder

Students will repeat each experiment three times to gain reliable data. Repeated experiments are called trials. Each student will need to perform his or her own trials to be as consistent as possible with the amount of force used. Different students may push or pull with varying levels of force, causing inconsistent data.

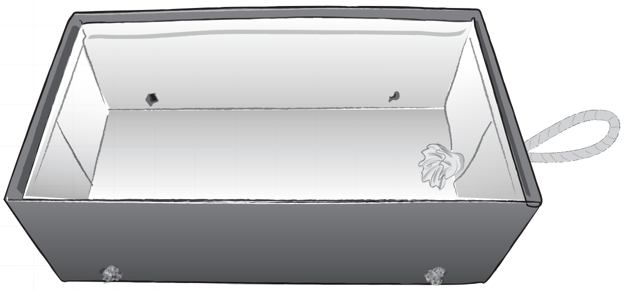
When students first begin to push or pull, the spring scale will measure a higher amount of force.

Advance Preparation

Poke a hole through the center of one end of a box using scissors or a box cutter. Cut a piece of rope 20 cm long, fold it in half, and tie a knot in it to create a loop. Feed the loop through the hole in the box.

Poke two holes on each long side of the shoe box using scissors or a box cutter. The holes need to be close to the bottom and near the ends of the box, directly across from one another. During the investigation, students will insert the dowel rods through the holes and put CDs on each end of the dowel rods, forming two wheel-and-axle sets.

It may be beneficial or necessary to review the directions on *RM 2: Wheel and Axle* with students.



Force and Motion

Teacher Instruction

- Instruct students to follow the directions on *RM 2* to complete Activities A–D.
- Instruct students to record their measurements on *RM 4: Simple Machines.*

Facilitation Questions

- How much force was used to push the box without wheels and axles? *Answers may vary slightly but should be around 0.5 N.*
- How much force was used to push the box with wheels and axles? *Answers may vary slightly but should be around 0 N because the spring scale cannot measure such a small force.*
- Was the box easier to push with or without the wheels and axles? Why? *The box with the wheels and axles was easier to push because the wheels and axles helped move the box.*
- How much force was used to pull the box without wheels and axles? *Answers may vary slightly but should be around 0.5 N.*
- How much force was used to pull the box with wheels and axles? *Answers may vary slightly but should be around 0 N because the spring scale cannot measure such a small force.*
- Was the box easier to pull with or without the wheels and axles? Why? *The box with the wheels and axles was easier to pull because the wheels and axles helped move the box.*
- Why did you repeat each trial three times? *Repeating trials improves the reliability of the results. For example, by doing three trials, a scientist can look at his or her results to see if the measurements all look similar. If one measurement is different from the other two, something may have gone wrong.*
- Did you demonstrate work in this activity? *Work was only demonstrated if the box ended in a different position from where it began. For example, if the box was placed back at the starting line after the completion of the activity, work was not demonstrated because the box started and ended in the same location. If the box was left at the finish line after the completion of the activity, work was demonstrated because the box ended in a different location from where it began.*

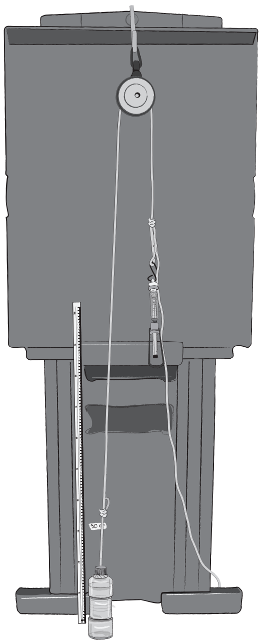
Force and Motion

- What simple machine was used to move the box in Activity B? *Two wheel-and-axle sets were used to move the box in Activity B. A wheel-and-axle is a simple machine.*

Elaborate, Part 2

Advance Preparation

For Activity B, hang the metal door hook on a door (classroom, cabinet, storage closet) or sturdy easel. Loop a piece of rope through the hole in the top of the pulley and hang it on the metal hook. Cut a piece of rope 4 meters long and feed one end through the pulley. Tie a knot near the end of the rope, creating a loop. Tie a water bottle to the opposite end of the rope. Make another loop in the rope about 30 cm above the water bottle.



Materials

For each student

- RM 4 from Elaborate, Part 1

For student groups

- RM 3
- nylon rope, 3/16" thick, 4 m long
- unopened water bottle
- door or sturdy easel
- pulley
- masking tape
- marker
- meter stick
- push-pull spring scale or pull spring scale,10 N maximum
- metal door hook

Content Builder

Students should observe the same amount of force needed for both Activities A and B. The same object is being lifted, but it may feel like less force is being used because the pulley allows students to use their body weight and gravity to their advantage by pulling down instead of lifting up. The main difference between Activities A and B is the direction of the applied force. If students observe more force needed for Activity B, it could be due to friction created between the pulley and the rope.

Teacher Instruction

- Instruct students to follow the directions on *RM 3: Pulley* to complete Activities A and B.

- Instruct students to record their measurements on *RM 4*.

Facilitation Questions

- How much force was used to raise the water bottle without the pulley? *Answers may vary slightly but should be around 5 N.*
- How much force was used to raise the water bottle with the pulley? *Answers may vary slightly but should be around 5 N.*
- Was it easier to raise the water bottle with or without the pulley? Why? *It was easier to raise the water bottle with the pulley because we were able to use our body weight and the force of gravity to our advantage.*
- Why did you repeat each trial three times? *Repeating trials improves the reliability of the results. For example, by doing three trials, a scientist can look at his or her results to see if the measurements all look similar. If one measurement is different from the other two, something may have gone wrong.*
- Did you demonstrate work in this activity? *We did not demonstrate work in this activity because the water bottle returned to its original resting position on the floor after we stopped pulling on the rope.*
- What simple machine was used to lift the water bottle? *A pulley was used to lift the water bottle. A pulley is a simple machine.*

Download Grade3_ Notebook_F&M from Drop Boxes in your Science Academies for Grades K–4 Project Share group to use on your SMART™ or Mimio® interactive whiteboard.

Science Notebook Entry

Differentiation Strategies

ELL: Use Prompt 1 with a sentence stem or allow students to draw answers.

G/T: Use Prompt 2.

1. Do you need simple machines in your everyday life? For example, how do you get to school every day?

   I ride in a ___________________ to get to school. It has _______________________, which are simple machines.

2. Do you need simple machines in your everyday life? Do you know someone who needs simple machines in his or her everyday life? What kinds of jobs use simple machines?

Science Notebook Entry Possible Answers

Cars and buses use wheels and axles to move. Shopping carts, wheelbarrows, wagons, strollers, and work dollies also use wheels and axles to move.

Cranes, sailboats, and some clotheslines use pulleys to lift or move heavy loads.

Visit http://www.voki.com to use Vokis for students to share their responses to the science notebook entry.

Evaluate

Teacher Instruction

Materials

For each student

- RM 5

- Instruct students to read each question and use the provided pictures to help them answer the questions.

Differentiation Strategy

ELL: Provide students the opportunity to answer questions orally.

RM 5 Answer Key

Picture A:

1. The rope is lifting the box, which means a pulling force is being used.
2. The force of gravity is pulling the box toward Earth's surface. Magnetism is not affecting the box.
3. Work is being demonstrated because force is being used to move the box from one location to another.

Picture B:

1. The boy is using a pushing force to move the skateboard forward.
2. Gravity is pulling the skateboard and the boy toward Earth's surface. Magnetism is not affecting the skateboard.
3. Work is being demonstrated because force is being used to move the skateboard and boy from one location to another.

Grade 3

RM 1: Forces at Work

Instructions

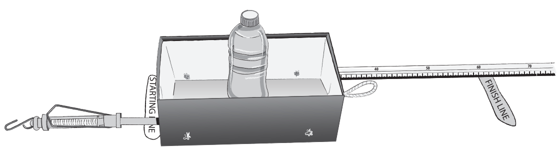
- Mark an *X* in the box if a certain force affects the activity.
- Think about why you believe that force affects the activity. Be ready to share your reasoning with your group, the class, and your teacher.
- Do not mark anything in the “Work” column until instructed by your teacher.

	Forces				
Activity	**Push**	**Pull**	**Magnetism**	**Gravity**	**Work**
Roll a ball.					
Press on a wall.					
Scoot your chair back.					
Feel magnets repel.					
Drop a ball.					
Press on a table or the teacher’s desk using only your pinkie finger.					
Lift a box from the floor to a tabletop.					
Raise an unopened water bottle.					

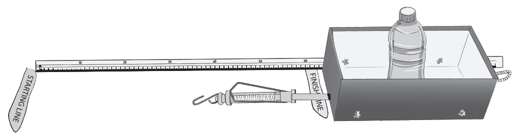
RM 2: Wheel and Axle

Activity A

1. Mark a starting line with a piece of masking tape and label it "Starting Line."
2. Measure 60 cm from the starting line and mark it with masking tape. Label it "Finish Line."
3. Place the shoe box with the back end resting against the starting line.
4. Place the unopened water bottle in the center of the box.
5. Center the push lever of the spring scale on the back end of the box. Make sure you are looking at the side of the spring scale showing newtons.
6. Push the box with a steady force until the back end of the box crosses the finish line.



Before



After

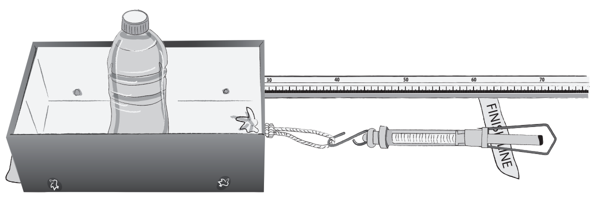
7. Observe the measurement on the spring scale from the time you begin pushing the box until the time you stop. You may notice that a greater force is needed to get the box moving.
8. Record on *RM 4: Simple Machines* the amount of force in newtons you used to push the box.
9. Repeat steps 5–7 two more times.
10. Each group member needs to perform and record the results of his or her own trials.

Grade 3

RM 2: Wheel and Axle continued

Activity B

1. Replace the box with the back end resting on the starting line.
2. Hook the spring scale through the loop in the rope. Make sure you are looking at the side of the spring scale showing newtons.
3. Pull the box until the back end is resting on the finish line.



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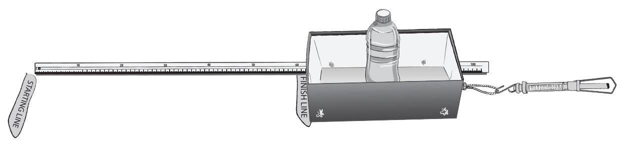


After

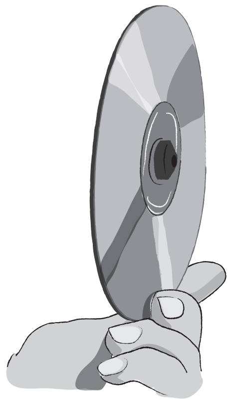
4. Observe the measurement on the spring scale from the time you begin pulling the box until the time you stop. You may notice that a greater force is needed to get the box moving.
5. Record on *RM 4* the amount of force in newtons you used to pull the box.
6. Repeat steps 1–5 two more times.
7. Each group member needs to perform and record the results of his or her own trials.

Grade 3

RM 2: Wheel and Axle continued

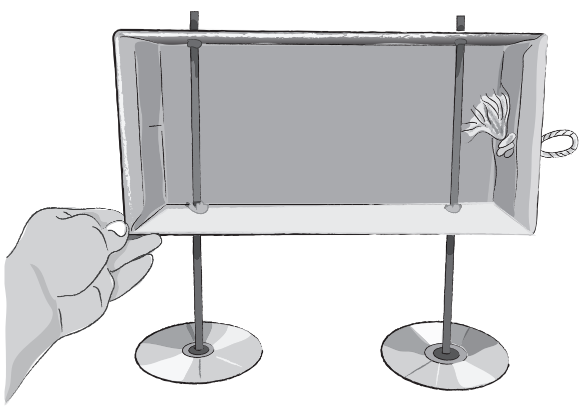
Activity C

1. Locate the pointed sides of the rubber wheel spacers and gently push them through the CDs until they click into place.



2. Lay two CDs flat on the table with the pointed sides of the rubber wheel spacers face down.
3. Push the end of one dowel rod through each wheel spacer.

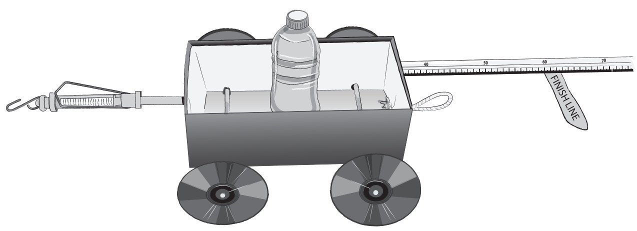
4. Feed the dowel rods through the holes in the box.



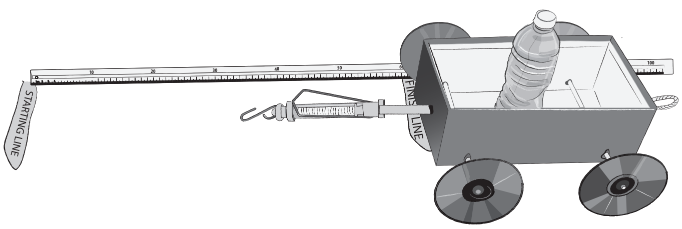
Grade 3

RM 2: Wheel and Axle continued

5. Lay two more CDs flat on the table with the pointed sides of the rubber wheel spacers face down.
6. Push the end of one dowel rod through each wheel spacer to create two wheel-and-axle sets.
7. Center the unopened bottle of water in the box.
8. Center the push lever of the spring scale on the back end of the box. Make sure you are looking at the side of the spring scale showing newtons.
9. Push the box with a steady force until the back end of the box crosses the finish line.



Before



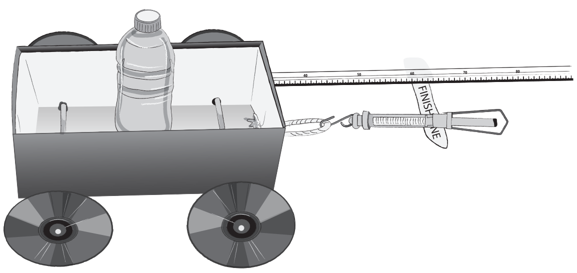
After

10. Observe the measurement on the spring scale from the time you begin pushing the box until the time you stop. You may notice that a greater force is needed to get the box moving.
11. Record on *RM 4* the amount of force in newtons that you used to push the box.
12. Repeat steps 8–11 two more times.
13. Each group member needs to perform and record the results of his or her own trials.

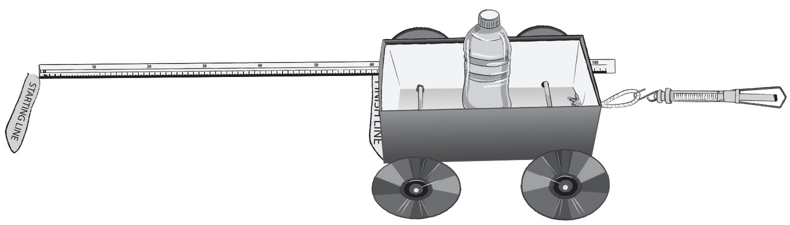
RM 2: Wheel and Axle continued

Activity D

1. Replace the box with the back end resting on the starting line.
2. Hook the spring scale through the loop in the rope. Make sure you are looking at the side of the spring scale showing newtons.
3. Pull the box until the back end is resting on the finish line.



Before



After

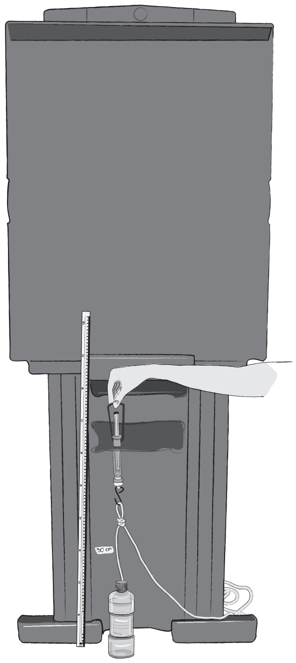
4. Observe the measurement on the spring scale from the time you begin pulling the box until the time you stop. You may notice that a greater force is needed to get the box moving.
5. Record on *RM 4* the amount of force in newtons you used to pull the box.
6. Repeat steps 1–5 two more times.
7. Each group member needs to perform and record the results to his or her own trials.

Grade 3

RM 3: Pulley

- Use the setup assigned to you.
- Measure 30 cm up from the floor, mark it with a piece of masking tape, and label it "30 cm."

Activity A

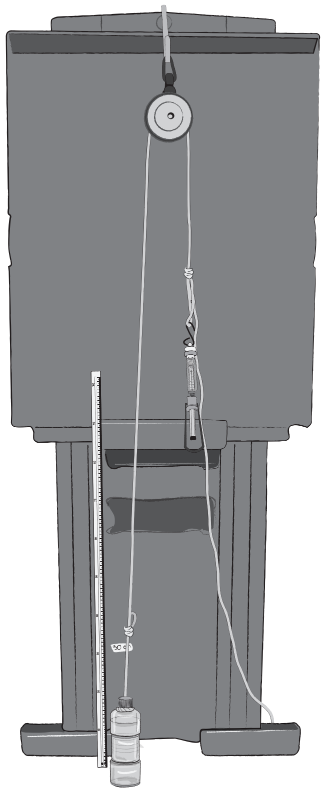


1. Hook the spring scale through the first loop in the rope. Make sure you are looking at the side of the spring scale showing newtons.
2. Lift until the bottom of the water bottle reaches the 30 cm mark.
3. Observe the measurement on the spring scale from the time you begin lifting the bottle until the time you stop. You may notice that a greater force is needed at the beginning of the lift.
4. Record on *RM 4: Simple Machines* the amount of force in newtons that you used to lift the bottle.
5. Repeat steps 1–4 two more times.
6. Each group member needs to perform and record the results of his or her own trials.

RM 3: Pulley continued

Activity B

1. Hook the spring scale back through the loop at the end of the rope. Make sure you are looking at the side of the spring scale showing newtons.



2. Pull the rope until the bottom of the water bottle reaches the 30 cm mark.
3. Observe the measurement on the spring scale from the time you begin pulling the rope until the time you stop. You may notice that a greater force is needed at the beginning of the pull.
4. Record on *RM 4* the amount of force in newtons you used to pull the rope.
5. Repeat steps 1–4 two more times.
6. Each group member needs to perform and record the results to his or her own trials.

Grade 3

RM 4: Simple Machines

Part 1

			Amount of Force Used (newtons)		
Activity			**Trial 1**	**Trial 2**	**Trial 3**
A	**Without wheels**	**Push the shoe box 60 cm.**			
B		Pull the shoe box 60.			
C	**With wheels**	**Push the shoe box 60 cm.**			
D		Pull the shoe box 60 cm.			

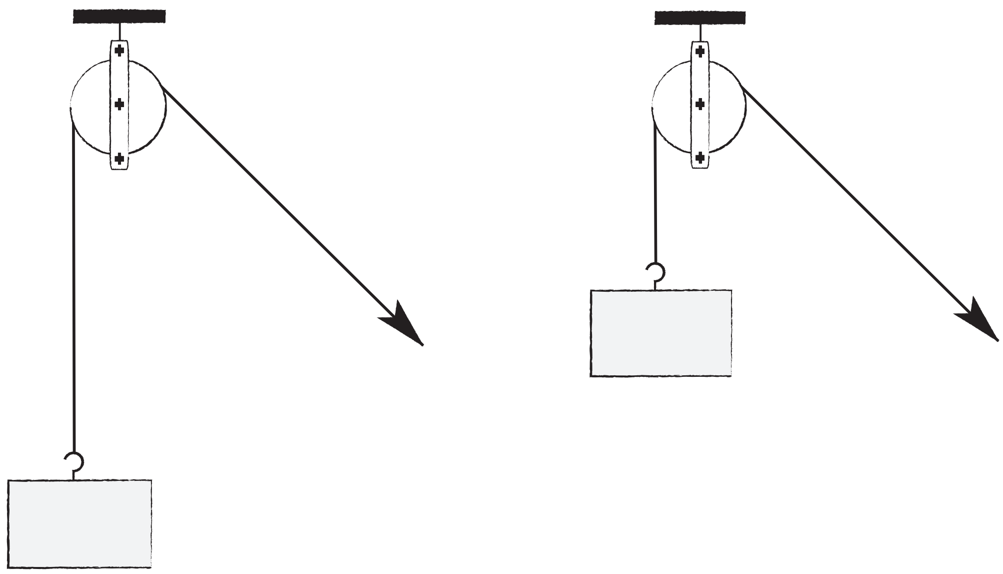
Part 2

		Amount of Force Used (newtons)		
Activity		**Trial 1**	**Trial 2**	**Trial 3**
A	**Raise the unopened water bottle 30 cm without a pulley.**			
B	Raise the unopened water bottle 30 cm with a pulley.			

Grade 3

RM 5: Forces at Work Assessment

Observe both pictures.



Before **After**

1. Are pushing or pulling forces acting on the block? How do you know?

___

___

___

2. Are the forces of gravity and magnetism acting on the block? How do you know?

___

___

___

3. Is work being demonstrated? If so, explain.

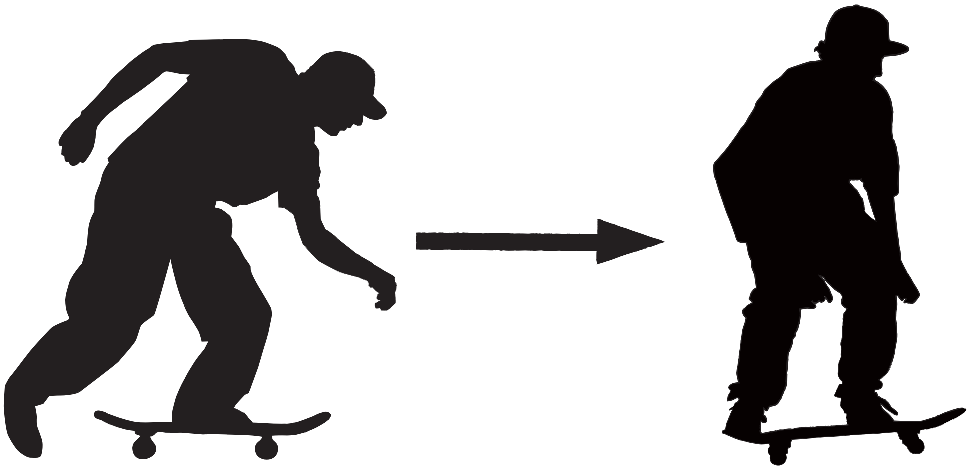
___

___

___

RM 5: Forces at Work Assessment continued

Observe both pictures.



Before **After**

1. Are pushing or pulling forces acting on the skateboard? How do you know?

____

____

____

2. Are the forces of gravity and magnetism acting on the skateboard? How do you know?

____

____

____

3. Is work being demonstrated? If so, explain.

____

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NOTES

NOTES