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Safety Guidelines for Science Investigations

1. **Follow instructions.** Listen carefully to your teacher’s instructions. Ask questions if you don’t know what to do.

2. **Don’t taste things.** No tasting anything or putting it near your mouth unless your teacher says it is safe to do so.

3. **Smell substances like a chemist.** When you smell a substance, don’t put your nose near it. Instead, gently move the air from above the substance to your nose. This is how chemists smell substances.

4. **Protect your eyes.** Wear safety goggles if something wet could splash into your eyes, if powder or dust might get in your eyes, or if something sharp could fly into your eyes.

5. **Protect your hands.** Wear gloves if you are working with materials or chemicals that could irritate your skin.

6. **Keep your hands away from your face.** Do not touch your face, mouth, ears, eyes, or nose while working with chemicals, plants, or animals.

7. **Tell your teacher if you have allergies.** This will keep you safe and comfortable during science class.

8. **Be calm and careful.** Move carefully and slowly around the classroom. Save your outdoor behavior for recess.

9. **Report all spills, accidents, and injuries to your teacher.** Tell your teacher if something spills, if there is an accident, or if someone gets injured.

10. **Avoid anything that could cause a burn.** Allow your teacher to work with hot water or hot equipment.

11. **Wash your hands after class.** Make sure to wash your hands thoroughly with soap and water after handling plants, animals, or science materials.
Making Blocks Move

Directions:
1. With your partner, use the materials in your bag to make a block start moving.
2. In each box, record the object you used to make the block move.
3. In each box, record or draw your observation.

<table>
<thead>
<tr>
<th>We used ______________________.</th>
<th>We used ______________________.</th>
</tr>
</thead>
<tbody>
<tr>
<td>We observed:</td>
<td>We observed:</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>We used ______________________.</td>
<td>We used ______________________.</td>
</tr>
<tr>
<td>We observed:</td>
<td>We observed:</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Daily Written Reflection

What do you want to know about forces?

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

Make a drawing if it helps you explain your thinking. Label your drawing.

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Getting Ready to Read: Forces All Around

Directions:
1. Before reading the book *Forces All Around*, read the sentences below.
2. If you agree with the sentence, write an “A” on the line before the sentence.
3. If you disagree with the sentence, write a “D” on the line before the sentence.
4. After you read the book, see if your ideas have changed. Be ready to explain your thinking.

_______ A push is a force, but a pull is not a force.

_______ When someone catches a ball, the force is the ball.

_______ If something is moving, that is evidence of a force.

_______ All forces can only happen when objects are touching.

_______ You can see evidence of forces when you play on the playground.
**Reading Reflection: Forces All Around**

Directions:
1. Turn to each page in the book that is listed in the first column of the table below.
2. In the second column, describe the evidence of a force in the picture in the book.
3. In the third column, record whether the force is a pull, a push, or not sure.

<table>
<thead>
<tr>
<th>Page number</th>
<th>Evidence of a force (What object is moving or stopping?)</th>
<th>Is it a push, a pull, or not sure?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Page 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Page 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Page 8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Page 11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Page 17</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Multiple Meaning Words

Directions:
Some words can mean more than one thing. For each word in the chart:
1. Read the sentence from the book *Forces All Around* that uses the word.
2. Read the two meanings the word can have.
3. Decide which meaning the word has in the sentence from the book and circle that meaning in the table.

<table>
<thead>
<tr>
<th>Word</th>
<th>Sentence from the book</th>
<th>Meaning 1</th>
<th>Meaning 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>force</td>
<td>When the skateboard started moving, that was evidence of a <em>force</em>.</td>
<td>a push or a pull</td>
<td>to make someone do something they don’t want to do</td>
</tr>
<tr>
<td>point</td>
<td>“So who won the game?” asked Lee. “How many <em>points</em> did we get?”</td>
<td>the sharp end of something</td>
<td>what you count in the score of a game</td>
</tr>
<tr>
<td>object</td>
<td>Everywhere, <em>objects</em> were starting to move and stopping moving.</td>
<td>a thing that can be seen or touched</td>
<td>to say that you disagree</td>
</tr>
</tbody>
</table>
Quick-Write: Evidence of Forces

Directions:
1. Record one or two ideas about the evidence of forces you found in the book *Forces All Around*.
2. Record in complete sentences, but don’t worry about making your writing perfect or organized.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Make a drawing if it helps you explain your thinking. Label your drawing.
Daily Written Reflection

What are some forces acting on you right now?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Make a drawing if it helps you explain your thinking. Label your drawing.
Moving Magnets

Directions:
1. See if you can make a magnet start moving without anything touching it.
2. Draw a picture of two ways that you made a magnet move. Include an arrow in each drawing to show the direction the magnet started moving.
Evidence of Non-Touching Forces

Directions:
1. Answer the question below and then record your evidence.
2. Use the words in the Word Bank when you record your evidence.

Can a force make an object start to move without anything touching the object? ________________________

<table>
<thead>
<tr>
<th>Word Bank</th>
</tr>
</thead>
<tbody>
<tr>
<td>force</td>
</tr>
<tr>
<td>touching force</td>
</tr>
<tr>
<td>flipped</td>
</tr>
</tbody>
</table>

What is your evidence?_______________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
Daily Written Reflection

Why do you think a floating train can rise above the tracks? What are your reasons for thinking that?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Make a drawing if it helps you explain your thinking. Label your drawing.
## Predict and Test: What Do Magnets Attract?

**Directions:**
1. For each row, predict whether the magnet (Object 1) will attract Object 2. Record your predictions in the fourth column.
2. Once you receive your magnet, test your predictions. Record your test results in the last column.
3. Continue this process as you complete the table on the next page.

<table>
<thead>
<tr>
<th>Object 1</th>
<th>Object 2</th>
<th>Is Object 2 metal?</th>
<th>Prediction: Do you think the magnet will <strong>attract</strong> or <strong>not attract</strong> this object?</th>
<th>Test: Did the magnet <strong>attract</strong> or <strong>not attract</strong> this object?</th>
</tr>
</thead>
<tbody>
<tr>
<td>magnet</td>
<td>wood</td>
<td>no</td>
<td></td>
<td></td>
</tr>
<tr>
<td>magnet</td>
<td>washer</td>
<td>yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>magnet</td>
<td>penny</td>
<td>yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>magnet</td>
<td>paper clip</td>
<td>yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>magnet</td>
<td>fastener 1</td>
<td>yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>magnet</td>
<td>fastener 2</td>
<td>yes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Predict and Test: What Do Magnets Attract? (continued)

<table>
<thead>
<tr>
<th>Object 1</th>
<th>Object 2</th>
<th>Is Object 2 metal?</th>
<th>Prediction: Do you think the magnet will attract or not attract this object?</th>
<th>Test: Did the magnet attract or not attract this object?</th>
</tr>
</thead>
<tbody>
<tr>
<td>magnet</td>
<td>foil</td>
<td>yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>magnet</td>
<td>twist tie</td>
<td>partly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>magnet</td>
<td>plastic spoon</td>
<td>no</td>
<td></td>
<td></td>
</tr>
<tr>
<td>magnet</td>
<td>steel spoon</td>
<td>yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>magnet</td>
<td>balloon</td>
<td>no</td>
<td></td>
<td></td>
</tr>
<tr>
<td>magnet</td>
<td>steel wool</td>
<td>yes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Daily Written Reflection

What did you learn from reading *Handbook of Forces* that was interesting or surprising to you? Why was it interesting or surprising?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Make a drawing if it helps you explain your thinking. Label your drawing.
Quick-Write: Explaining Magnet Tricks

Directions:
1. Write about one of the magnet tricks you created or observed. Explain how you think it worked. You can look back at the reference book, *Handbook of Forces*, if it helps you explain the magnet trick.
2. Use the words in the Word Bank when you write.

<table>
<thead>
<tr>
<th>Word Bank</th>
</tr>
</thead>
<tbody>
<tr>
<td>attract</td>
</tr>
</tbody>
</table>

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Make a drawing if it helps you explain your thinking. Label your drawing.
Daily Written Reflection

What was your favorite magnet trick? Why?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Make a drawing if it helps you explain your thinking. Label your drawing.
Getting Ready to Read:
What My Sister Taught Me About Magnets

Directions:
2. If you agree with the sentence, write an “A” on the line before the sentence.
3. If you disagree with the sentence, write a “D” on the line before the sentence.
4. After you read the book, see if your ideas have changed. Be ready to explain your thinking.

_______ All magnets are the same shape.

_______ All magnets have two poles: a north pole and a south pole.

_______ The north pole of one magnet will pull toward the north pole of another magnet.

_______ When a magnet pulls a paper clip toward it, this is because of a force.

_______ Magnets attract all metals.
Reading Reflection: What My Sister Taught Me About Magnets

The little sister in this book gives her big sister many explanations that help the big sister understand more about magnets. In the boxes below, record an important idea from each explanation that the little sister teaches her big sister.

<table>
<thead>
<tr>
<th>Explanation 1: page 7</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Explanation 2: pages 10–11</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Explanation 3: page 16</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>
## Multiple Meaning Words

Directions:
Some words can mean more than one thing. For each word in the chart:
1. Read the sentence from the book *What My Sister Taught Me About Magnets* that uses the word.
2. Read the two meanings the word can have.
3. Decide which meaning the word has in the sentence from the book and circle that meaning in the table.

<table>
<thead>
<tr>
<th>Word</th>
<th>Sentence from the book</th>
<th>Meaning 1</th>
<th>Meaning 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>pole</td>
<td>Every magnet has a north <strong>pole</strong> and a south <strong>pole</strong>.</td>
<td>the part of a magnet that pushes or pulls</td>
<td>a long, thin object</td>
</tr>
<tr>
<td>kind</td>
<td>I think magnets only attract some <strong>kinds</strong> of metal.</td>
<td>nice or friendly</td>
<td>type or sort</td>
</tr>
<tr>
<td>mine</td>
<td>We talked about <strong>mines</strong> where people find metal underground.</td>
<td>a place where people dig for metal, gems, rock, or other useful things</td>
<td>belonging to me</td>
</tr>
<tr>
<td>table</td>
<td>Here is the <strong>table</strong> my sister made to record what we found out.</td>
<td>a kind of furniture</td>
<td>a way of recording information by using words and numbers inside lines and boxes</td>
</tr>
</tbody>
</table>
Daily Written Reflection

In this unit so far, when have you felt most like a scientist? Why?

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

Make a drawing if it helps you explain your thinking. Label your drawing.
Chapter 1: Word Relationships

Directions:
1. Work with your partner to create sentences that use at least two of the Word Relationships Cards in each sentence.
2. Record several of the sentences you created.

1. ____________________________________________________________
   ____________________________________________________________

2. ____________________________________________________________
   ____________________________________________________________

3. ____________________________________________________________
   ____________________________________________________________

4. ____________________________________________________________
   ____________________________________________________________

Make a drawing if it helps you explain your thinking. Label your drawing.
What Is a Scientific Explanation?

1. It answers a question about how or why something happens.
2. It describes things that are not easy to observe.
3. It is based on the ideas you have learned from investigations and text.
4. It uses scientific language.
5. It is written for an audience.
6. It begins with a topic sentence.
7. It ends with a concluding statement.
Chapter 1: Writing a Scientific Explanation

Answer the question below. Use words from the Word Bank as you write.

<table>
<thead>
<tr>
<th>Word Bank</th>
</tr>
</thead>
<tbody>
<tr>
<td>force</td>
</tr>
<tr>
<td>touching force</td>
</tr>
<tr>
<td>magnet</td>
</tr>
<tr>
<td>push</td>
</tr>
<tr>
<td>magnetic force</td>
</tr>
<tr>
<td>pull</td>
</tr>
<tr>
<td>exert</td>
</tr>
<tr>
<td>repel</td>
</tr>
<tr>
<td>attract</td>
</tr>
<tr>
<td>non-touching force</td>
</tr>
</tbody>
</table>

Why did the paper clip move toward the magnet?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Make a drawing if it helps you explain your thinking. Label your drawing.
Chapter 1: Check Your Understanding

This is a chance for you to reflect on your learning so far. This is not a test. Be open and truthful when you respond.

Scientists investigate in order to figure out how things work. Am I getting closer to figuring out how the floating train works?

I understand why the train rises. _____ Yes _____ Not yet
I understand why the train falls. _____ Yes _____ Not yet
I understand why the train floats. _____ Yes _____ Not yet
I understand why the train floats and then falls. _____ Yes _____ Not yet

What about the floating train or about forces are you still wondering?
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Make a drawing if it helps you explain your thinking. Label your drawing.
Daily Written Reflection

Why do you think things fall to the ground?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Make a drawing if it helps you explain your thinking. Label your drawing.
Evidence of Downward Force

Directions:
1. Try to find evidence of downward force on the paper clip, the domino, and the book.
2. Use your sense of sight and your sense of touch.
3. You can drop the paper clip and domino, but you cannot drop the book.
4. Record your observations below. Use the following sentence starters when you write.
   - I saw . . .
   - I felt . . .

Observations from my sense of sight:

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Observations from my sense of touch:

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

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Daily Written Reflection

Describe a time when you saw something slide or roll down a hill or a slope. What force do you think caused that movement to start?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Make a drawing if it helps you explain your thinking. Label your drawing.
OBSERVING FORCES IN A CHAIN REACTION

Directions:
1. Set up the chain reaction.
2. Run the chain reaction by letting the ball roll down the ramp.
3. Set up the chain reaction and run it again. Run it for a total of four times.
4. For each part of the chain reaction (on this page and on the next three pages), record your observations and ideas.

Part 1: Ball rolls down the ramp

Which object or objects were part of the force?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Which force or forces acted? (Circle your answer.)
touching force magnetic force gravity

Other observations and ideas:

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
Observing Forces in a Chain Reaction (continued)

Part 2: Domino tips over

Which object or objects were part of the force?

___________________________________________________________________

___________________________________________________________________

Which force or forces acted? (Circle your answer.)

touching force               magnetic force               gravity

Other observations and ideas:

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________
Observing Forces in a Chain Reaction (continued)

Part 3: Ball magnet starts moving
Which object or objects were part of the force?
________________________________________________________________________
________________________________________________________________________
Which force or forces acted? (Circle your answer.)
touching force               magnetic force               gravity
Other observations and ideas:
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
Observing Forces in a Chain Reaction (continued)

Part 4: Ball magnet goes toward the ring magnet

Which object or objects were part of the force?
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Which force or forces acted? (Circle your answer.)
touching force       magnetic force       gravity

Other observations and ideas:
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

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Writing About Gravity

Directions:
1. How did gravity act in the chain reaction?
2. Record your explanation below. Use some of the words from the Word Bank as you write.

<table>
<thead>
<tr>
<th>Word Bank</th>
</tr>
</thead>
<tbody>
<tr>
<td>gravity</td>
</tr>
<tr>
<td>touching force</td>
</tr>
</tbody>
</table>

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Make a drawing if it helps you explain your thinking. Label your drawing.
Daily Written Reflection

Draw a new idea for a different chain reaction that includes gravity, magnetic force, and touching force.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Describe what would happen in your chain reaction. Include an explanation about the forces that would make things move.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
Reading About Gravity: Two Objects?

What evidence did you find in the book that helps you answer this question: Does the force of gravity act between two objects?

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

Make a drawing if it helps you explain the evidence you found.
Reading About Gravity: My Purpose for Reading

Directions:
1. With your partner, choose a purpose for reading and record it below.
2. As you read, use sticky notes to mark evidence in the book that helps you with your reading purpose.

Reading purpose: _____________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

What did you find out about your reading purpose?
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Make a drawing if it helps you explain the evidence you found.
Daily Written Reflection

Describe a time that you felt evidence of the force of gravity with your sense of touch.

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

Make a drawing if it helps you explain your thinking. Label your drawing.
Chapter 2: Word Relationships

Directions:
1. Work with your partner to create sentences that use at least two of the Word Relationships Cards in each sentence.
2. Create some sentences that explain how gravity and magnetic force are the same or different.
3. Record several of the sentences you created.

1. ____________________________________________________________
   ____________________________________________________________

2. ____________________________________________________________
   ____________________________________________________________

3. ____________________________________________________________
   ____________________________________________________________

4. ____________________________________________________________
   ____________________________________________________________

Make a drawing if it helps you explain your thinking. Label your drawing.
Diagramming Forces

Directions:
1. In each box, draw an arrow to show the direction of the force on the object that has the object label.
2. Add labels to the diagram, using words from the Word Bank.

<table>
<thead>
<tr>
<th>Word Bank</th>
</tr>
</thead>
<tbody>
<tr>
<td>push</td>
</tr>
<tr>
<td>pull</td>
</tr>
<tr>
<td>attract</td>
</tr>
<tr>
<td>repel</td>
</tr>
<tr>
<td>gravity</td>
</tr>
<tr>
<td>touching force</td>
</tr>
<tr>
<td>magnetic force</td>
</tr>
</tbody>
</table>

Falling ball

Ball hitting domino

Domino hitting ball magnet

Ball magnet moving toward ring magnet

© 2016 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.
The ball is rolling down the ramp.

Which force is acting on the ball?

___________________________________________________________________
___________________________________________________________________

Why do you think so?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Which objects are involved?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
Which Force Is Acting? (continued)

The paper clip is moving toward the magnet.

Which force is acting on the paper clip?

___________________________________________________________________
___________________________________________________________________

Why do you think so?

___________________________________________________________________
___________________________________________________________________

Which objects are involved?

___________________________________________________________________
___________________________________________________________________
Daily Written Reflection

How would you explain the force of gravity to a five-year-old? What might be tricky for a five-year-old to understand?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Make a drawing if it helps you explain your thinking. Label your drawing.
Writing a Scientific Explanation: Demonstration 1

Directions:
1. Think about the first demonstration. Record an explanation of what you observed. Why did the magnet move to the metal surface and stick?
2. Use words from the Word Bank when you are writing.

<table>
<thead>
<tr>
<th>Word Bank</th>
</tr>
</thead>
<tbody>
<tr>
<td>attract</td>
</tr>
<tr>
<td>magnetic force</td>
</tr>
</tbody>
</table>

___________________________________________________________________
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___________________________________________________________________
___________________________________________________________________

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Writing a Scientific Explanation: Demonstration 1 (continued)

Make a drawing about the first demonstration if it helps you explain your thinking. Label your drawing.
Writing a Scientific Explanation: Demonstration 2

Directions:
1. Think about the second demonstration. Record an explanation of what you observed. Why did the magnet fall?
2. Use words from the Word Bank when you are writing.

<table>
<thead>
<tr>
<th>Word Bank</th>
</tr>
</thead>
<tbody>
<tr>
<td>attract</td>
</tr>
<tr>
<td>magnetic force</td>
</tr>
</tbody>
</table>

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
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___________________________________________________________________
Writing a Scientific Explanation: Demonstration 2 (continued)

Make a drawing about the second demonstration if it helps you explain your thinking. Label your drawing.
Chapter 2: Check Your Understanding

This is a chance for you to reflect on your learning so far. This is not a test. Be open and truthful when you respond.

Scientists investigate in order to figure out how things work. Am I getting closer to figuring out how the floating train works?

I understand why the train rises. _____ Yes _____ Not yet
I understand why the train falls. _____ Yes _____ Not yet
I understand why the train floats. _____ Yes _____ Not yet
I understand why the train floats and then falls. _____ Yes _____ Not yet

What about the floating train or about forces are you still wondering?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Make a drawing if it helps you explain your thinking. Label your drawing.
Daily Written Reflection

If you were a forces scientist, which kinds of forces would you most like to investigate? Why?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Make a drawing if it helps you explain your thinking. Label your drawing.
Keeping a Book From Falling

Directions:
1. Hold a book on the palm of your hand, with your arm stretched out.
2. Observe with your sense of sight and your sense of touch.
3. Answer the questions below.

What forces were acting on the book?
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Why didn’t the book fall to the ground?
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Changes or additions I want to make to my answers:
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
Making a Magnet Float

Draw what you did to make one magnet float. Label your drawing.
Writing About the Floating Magnet

Directions:
1. Write about what you observed with the floating magnet.
   • Why did the magnet float?
   • What forces were acting on the floating magnet?
2. Use words from the Word Bank when you are writing.

<table>
<thead>
<tr>
<th>Word Bank</th>
</tr>
</thead>
<tbody>
<tr>
<td>attract</td>
</tr>
<tr>
<td>magnetic force</td>
</tr>
</tbody>
</table>
Daily Written Reflection

What is an object you can think of that floats in the air? Do you think gravity is acting on this object? Explain your thinking.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Make a drawing if it helps you explain your thinking. Label your drawing.
Floating Paper Clip

Directions:
1. Draw the paper clip, string, and magnets to complete the device.
2. Under the diagram, record one force acting on the paper clip and then record the two objects that the force is acting between.
3. Record a second force acting on the paper clip and then record the two objects the force is acting between.

First force:
_______________________________ is one force acting on the paper clip.
What two objects is this force acting between?
________________________________ and ________________________________

Second force:
_______________________________ is another force acting on the paper clip.
What two objects is this force acting between?
________________________________ and ________________________________
**Multiple Meaning Words**

Directions:
Some words can mean more than one thing. For each word in the chart:
1. Read the sentence from the book *Handbook of Forces* that uses the word.
2. Read the two meanings the word can have.
3. Decide which meaning the word has in the sentence from the book and circle that meaning in the table.

<table>
<thead>
<tr>
<th>Word</th>
<th>Sentence from the book</th>
<th>Meaning 1</th>
<th>Meaning 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>multiple</td>
<td>The movement of the ball up and then down is evidence of <em>multiple</em> forces.</td>
<td>more than one</td>
<td>a number that can be made by multiplying a smaller number (for example, 6 is a multiple of 2)</td>
</tr>
<tr>
<td>acting</td>
<td>The multiple forces <em>acting</em> on an object can have different strengths.</td>
<td>exerted</td>
<td>pretending to be someone else for a movie or play</td>
</tr>
<tr>
<td>wind</td>
<td>When you fly a kite, the <em>wind</em> pushes on the kite while you pull it with the string.</td>
<td>to wrap around something</td>
<td>moving air</td>
</tr>
</tbody>
</table>
Daily Written Reflection

Scientists pay close attention to when things change and when they are stable. If a scientist was looking at the Floating Paper Clip Device, when would she say things are stable? When would she say things are changing?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Make a drawing if it helps you explain your thinking. Label your drawing.
Writing a Scientific Explanation About the Floating Paper Clip

Directions:
1. Write a scientific explanation to answer the question below.
2. Use words from the Word Bank when you are writing.

<table>
<thead>
<tr>
<th>Word Bank</th>
</tr>
</thead>
<tbody>
<tr>
<td>attract</td>
</tr>
<tr>
<td>balanced forces</td>
</tr>
<tr>
<td>change</td>
</tr>
<tr>
<td>exert</td>
</tr>
<tr>
<td>force</td>
</tr>
<tr>
<td>magnet</td>
</tr>
<tr>
<td>repel</td>
</tr>
<tr>
<td>gravity</td>
</tr>
<tr>
<td>magnetic force</td>
</tr>
<tr>
<td>multiple forces</td>
</tr>
<tr>
<td>object</td>
</tr>
<tr>
<td>stable</td>
</tr>
</tbody>
</table>

Why does the paper clip float?
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
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___________________________________________________________________
Daily Written Reflection

What do you think would happen if you placed a paper clip in the middle of two magnets—one very strong magnet and one very weak magnet? Explain your thinking.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Make a drawing if it helps you explain your thinking. Label your drawing.
Diagramming Balanced and Unbalanced Forces

Directions:
1. On each diagram, draw arrows to represent the direction of the force or forces acting on the paper clip.
2. Label each arrow with the name of the force.
3. At the top of each box, label each diagram either balanced forces or unbalanced forces.
Data Table: Forces on an Object

Directions:
1. Review the data in the table below and discuss it with your partner.
2. Analyze the data by talking about the patterns you notice.
3. You can use the sentence starters on the board to help you analyze the data.

<table>
<thead>
<tr>
<th>Object</th>
<th>Force 1</th>
<th>Force 2</th>
<th>Balanced or unbalanced?</th>
<th>Does the object start moving?</th>
</tr>
</thead>
<tbody>
<tr>
<td>paper clip</td>
<td>gravity (downward)</td>
<td>magnetic force (upward)</td>
<td>balanced</td>
<td>no</td>
</tr>
<tr>
<td>paper clip</td>
<td>gravity (downward)</td>
<td>none</td>
<td>unbalanced</td>
<td>yes (downward)</td>
</tr>
<tr>
<td>rope in tug-of-war game</td>
<td>touching force (pulling left stronger)</td>
<td>touching force (pulling right weaker)</td>
<td>unbalanced</td>
<td>yes (to the left)</td>
</tr>
<tr>
<td>kite on a string</td>
<td>wind (upward)</td>
<td>touching force of string (downward)</td>
<td>balanced</td>
<td>no</td>
</tr>
<tr>
<td>book held in hand</td>
<td>gravity (downward)</td>
<td>touching force (upward)</td>
<td>balanced</td>
<td>no</td>
</tr>
<tr>
<td>ball magnet</td>
<td>magnetic force (from a ring magnet)</td>
<td>none</td>
<td>unbalanced</td>
<td>yes (toward the ring magnet)</td>
</tr>
</tbody>
</table>
Chapter 3: Word Relationships

Directions:
1. Work with your partner to create sentences that use at least two of the Word Relationships Cards in each sentence.
2. Create some sentences that explain what you have learned about balanced and unbalanced forces.
3. Record several of the sentences you created.

1. ____________________________________________________________
   ____________________________________________________________

2. ____________________________________________________________
   ____________________________________________________________

3. ____________________________________________________________
   ____________________________________________________________

4. ____________________________________________________________
   ____________________________________________________________

Make a drawing if it helps you explain your thinking. Label your drawing.

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Daily Written Reflection

What was the most interesting thing you learned about the magnetic hoverboard? What questions do you still have about the hoverboard?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Make a drawing if it helps you explain your thinking. Label your drawing.
Getting Ready to Read: Hoverboard

Directions:
1. Before reading the book Hoverboard, read the sentences below.
2. If you agree with the sentence, write an “A” on the line before the sentence.
3. If you disagree with the sentence, write a “D” on the line before the sentence.
4. After you read the book, see if your ideas have changed. Be ready to explain your thinking.

_______ A hoverboard works by turning gravity on and off.

_______ Engineers needed to use balanced forces to make a hoverboard that works.

_______ Magnets in the ceiling attract the hoverboard and make it float.

_______ There are magnets that can be turned on and off.

_______ The hoverboard is the only invention that uses the science of balanced forces.

_______ Repelling magnets make the hoverboard float.
The diagram below is from page 11 in the book Hoverboard. Sometimes, a diagram has a caption, which is a sentence that tells the main idea of what the diagram shows. Write a caption for this diagram.

My caption:
Multiple Meaning Words

Directions:
Some words can mean more than one thing. For each word in the chart:
1. Read the sentence from the book *Hoverboard* that uses the word.
2. Read the two meanings the word can have.
3. Decide which meaning the word has in the sentence from the book and circle that meaning in the table.

<table>
<thead>
<tr>
<th>Word</th>
<th>Sentence from the book</th>
<th>Meaning 1</th>
<th>Meaning 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>hardest</td>
<td>Designing a hoverboard that is safe for every rider, every time, is the <strong>hardest</strong> part.</td>
<td>most difficult</td>
<td>least soft</td>
</tr>
<tr>
<td>test</td>
<td>The engineers have to <strong>test</strong> these hoverboards hundreds of times.</td>
<td>try out to see how something works</td>
<td>an activity in school to find out what students know</td>
</tr>
<tr>
<td>Earth</td>
<td><strong>Earth</strong> actually pulls everything toward its center.</td>
<td>dirt or soil</td>
<td>the planet on which we live</td>
</tr>
<tr>
<td>type</td>
<td>The magnets in the hoverboard are a <strong>type</strong> of electromagnet.</td>
<td>to write by using a keyboard</td>
<td>kind or sort</td>
</tr>
</tbody>
</table>
Which Forces Were Acting on the Hoverboard?

Part 1: Floating
Which forces were acting on the hoverboard while it was floating?

___________________________________________________________________

Were the forces balanced or unbalanced? What is your evidence?

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

Part 2: Falling
Which forces were acting on the hoverboard while it was falling?

___________________________________________________________________

Were the forces balanced or unbalanced? What is your evidence?

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________
Chapter 3: Check Your Understanding

This is a chance for you to reflect on your learning so far. This is not a test. Be open and truthful when you respond.

Scientists investigate in order to figure out how things work. Am I getting closer to figuring out how the floating train works?

I understand why the train rises. ______ Yes ______ Not yet
I understand why the train falls. ______ Yes ______ Not yet
I understand why the train floats. ______ Yes ______ Not yet
I understand why the train floats and then falls. ______ Yes ______ Not yet

What about the floating train or about forces are you still wondering?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Make a drawing if it helps you explain your thinking. Label your drawing.
Daily Written Reflection

When is the floating train stable? What is your evidence?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Make a drawing if it helps you explain your thinking. Label your drawing.
You can use this page to record notes or create drawings.
Diagramming the Floating Train

Directions:
1. On this page and the next page, draw arrows on each of the four diagrams to represent the direction of the force acting on the train.
2. Label each arrow with the name of the force.
3. Label these forces either balanced or unbalanced.

1. The train rests on the track.

2. The track is turned on. The train starts to rise.
Diagramming the Floating Train (continued)

3. The train is floating above the track.

4. The track is turned off. The train starts to fall.
Daily Written Reflection

In the last lesson, you made diagrams of the forces acting on the floating train. Think of another kind of vehicle. What might be some of the forces acting on this vehicle?

Vehicle: ____________________________________________________________

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Make a drawing if it helps you explain your thinking. Label your drawing.
Daily Written Reflection

How have you acted like a scientist during this unit about forces and the floating train?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Make a drawing if it helps you explain your thinking. Label your drawing.
Getting Ready to Read: Explaining a Bridge

Directions:
1. Before reading the book Explaining a Bridge, read the sentences below.
2. If you agree with the sentence, write an “A” on the line before the sentence.
3. If you disagree with the sentence, write a “D” on the line before the sentence.
4. After you read the book, see if your ideas have changed. Be ready to explain your thinking.

_______ An earthquake can make a bridge fall down.

_______ Engineers use models to teach people how things work.

_______ Cars and trucks push down on bridges, but bridges don’t push back upward.

_______ Anyone can become an engineer.

_______ All bridges have the same basic shape.

_______ Most bridges use magnetic force to balance the force of gravity.

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Purpose for Reading Explaining a Bridge

Directions:
1. With your partner, choose a purpose for reading and record it below.
2. As you read, use sticky notes to mark evidence in the book that helps with your reading purpose.
3. Record the evidence you found.

Reading purpose: ___________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

The evidence I found:
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
Reading Reflection: Explaining a Bridge

Imagine your own bridge and draw it. Add a label that explains what upward force on the bridge will balance the downward force of gravity.
Multiple Meaning Words

Directions:
Some words can mean more than one thing. For each word in the chart:
1. Read the sentence from the book *Explaining a Bridge* that uses the word.
2. Read the two meanings the word can have.
3. Decide which meaning the word has in the sentence from the book and circle that meaning in the table.

<table>
<thead>
<tr>
<th>Word</th>
<th>Sentence from the book</th>
<th>Meaning 1</th>
<th>Meaning 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>fall</td>
<td>That makes some people afraid that the new bridge could <strong>fall</strong>.</td>
<td>drop down</td>
<td>autumn, a season</td>
</tr>
<tr>
<td>engineer</td>
<td>Maroney is one of the <strong>engineers</strong> who helped design the new Bay Bridge.</td>
<td>someone who drives a train</td>
<td>someone who uses scientific knowledge to design something or solve a problem</td>
</tr>
<tr>
<td>model</td>
<td>These <strong>models</strong> help people understand how the real bridge works.</td>
<td>an object, diagram, or computer program that helps us understand something by making it simpler or easier to see</td>
<td>a person whose job it is to get his or her picture taken</td>
</tr>
<tr>
<td>cable</td>
<td>The <strong>cables</strong> go from the roadway up to tall towers.</td>
<td>a strong rope, often made of metal</td>
<td>a way of getting television shows</td>
</tr>
</tbody>
</table>
Chapter 4: Check Your Understanding

This is a chance for you to reflect on your learning so far. This is not a test. Be open and truthful when you respond.

Scientists investigate in order to figure out how things work. Am I getting closer to figuring out how the floating train works?

I understand why the train rises. _____ Yes _____ Not yet
I understand why the train falls. _____ Yes _____ Not yet
I understand why the train floats. _____ Yes _____ Not yet
I understand why the train floats and then falls. _____ Yes _____ Not yet

What about the floating train or about forces are you still wondering?

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

Make a drawing if it helps you explain your thinking. Label your drawing.
analyze: to make sense of data
analizar: pensar y entender los datos

attract: to pull on an object, even without touching it
atraer: jalar a un objeto, aún sin tocarlo

balanced forces: multiple forces of equal strength acting on an object
fuerzas en balance: varias fuerzas de la misma intensidad actuando en un objeto

data: information collected in an investigation
datos: la información recolectada durante una investigación

design: to think of a new way to make something
diseñar: pensar en una nueva manera para construir algo

diagram: an illustration that explains how something works or what its parts are
diagrama: una ilustración que explica como funciona algo o cuales son sus partes

electromagnet: kind of magnet that can be turned on and off
electromán: un tipo de imán que se puede prender y apagar

engineer: a person who uses science knowledge to design something in order to solve a problem
ingeniero: una persona que usa conocimientos científicos para diseñar algo que resuelva un problema

evidence: information that helps explain something or answer a question
evidencia: información que ayuda explicar algo o contestar una pregunta
**Glossary (continued)**

**exert:** to cause a force to act on an object  
**ejercer:** causar una fuerza que actúe en un objeto

**explain:** to describe how something works or why something happens  
**explicar:** describir cómo algo funciona o porqué algo pasa

**explanation:** a description of how something works or why something happens  
**explicación:** una descripción de cómo algo funciona o porqué algo pasa

**force:** a push or a pull  
**fuerza:** un empujón o un jalón

**gravity:** the pull between Earth and other objects, which acts even without touching  
**gravedad:** el jalón entre la Tierra y otros objetos, lo cual actúa aún sin tocar

**investigate:** to try to learn more about something  
**investigar:** intentar aprender más acerca de algo

**investigation:** an attempt to find out about something  
**investigación:** un intento para entender más acerca de algo

**magnet:** an object that pulls on some kinds of metal and pushes and pulls on other magnets, even without touching them  
**imán:** un objeto que atrae a algunos tipos de metal, y que atrae y repele a otros imanes aún sin tocarlos

**magnetic force:** the push or pull between two magnets, or the pull of a magnet on some kinds of metal  
**fuerza magnética:** el empujón o jalón entre dos imanes, o o jalón entre un imán y algunos tipos de metal
model: an object, diagram, or computer program that helps us understand something by making it simpler or easier to see
modelo: un objeto, un diagrama, o un programa de computadora que nos ayuda a entender algo en una forma más sencilla o más fácil de ver

non-touching force: a force that acts between objects that are not touching each other
fuerza a distancia: una fuerza que actúa entre objetos que no se están tocando

observation: information that you gather with any of the five senses
observación: información que reúnes con cualquier de los cinco sentidos

observe: to use any of the five senses to gather information about something
observar: usar cualquier de los cinco sentidos para recolectar información acerca de algo

pole: the part of a magnet that pushes or pulls
polo magnético: la parte de un imán que empuja o jala

repel: to push on an object, even without touching it
repeler: empujar un objeto, aún sin tocarlo

touching force: a force that acts between objects that are touching each other
fuerza de contacto: una fuerza que actúa entre objetos que se tocan

unbalanced forces: multiple forces of unequal strength acting on an object
fuerzas no en balance: varias fuerzas de diferentes intensidades actuando en un objeto
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Jonathan Braidman     John Erickson         Trudihope Schlomowitz
Marco Antonio Bravo    Kirsten Letofsky      Jade Sharify Talbot
Joan Carey            Deirdre MacMillan
Gina N. Cervetti       Eve Ryser

Amplify:

Irene Chan      Charvi Magdaong      Matt Reed
Samuel Crane     Thomas Maher        Eve Silberman
Shira Kronzon    Rick Martin         Steven Zavari

Credits:

Illustration: Page 62: Juan Tenorio
Your Investigation Notebook

Scientists use notebooks to keep track of their investigations. They record things they learn from other scientists. Sometimes they draw or make diagrams. They record ideas and information they want to remember.

Your Investigation Notebook is a place for you to keep track of:

- investigations you do in class.
- what you learn from reading science books.
- your questions, predictions, and observations.
- your explanations and the evidence you find to support those explanations.
- your ideas!