

Balancing Forces:

Investigating Floating Trains



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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.

Name: _____ Date: _____

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.

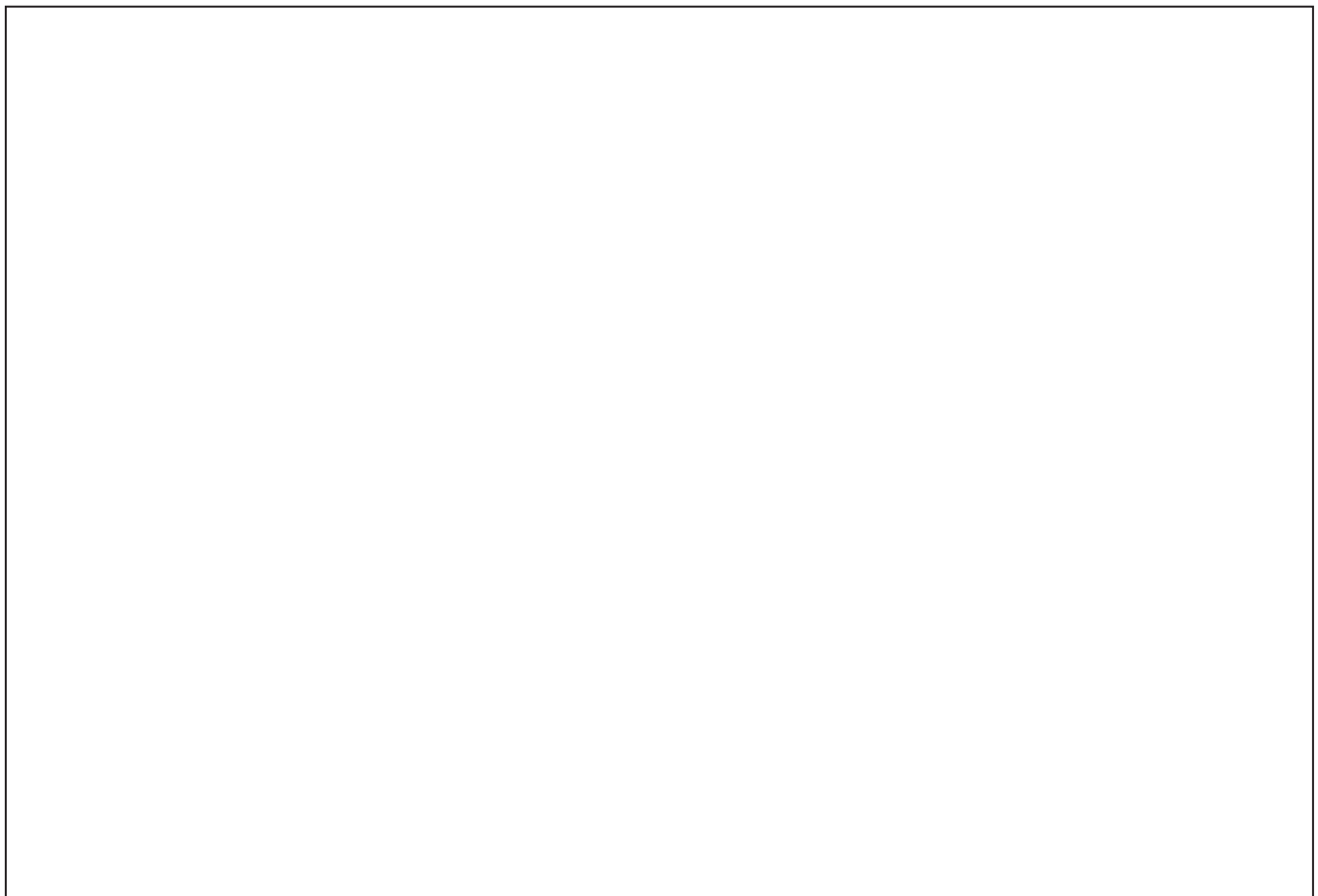
<p>We used _____.</p> <p>We observed:</p>	<p>We used _____.</p> <p>We observed:</p>
<p>We used _____.</p> <p>We observed:</p>	<p>We used _____.</p> <p>We observed:</p>

Name: _____ Date: _____

Daily Written Reflection

What do you want to know about forces?

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



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.

Page number	Evidence of a force (What object is moving or stopping?)	Is it a push, a pull, or not sure?
Page 3		
Page 7		
Page 8		
Page 11		
Page 17		

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.

Word	Sentence from the book	Meaning 1	Meaning 2
force	When the skateboard started moving, that was evidence of a force .	a push or a pull	to make someone do something they don't want to do
point	"So who won the game?" asked Lee. "How many points did we get?"	the sharp end of something	what you count in the score of a game
object	Everywhere, objects were starting to move and stopping moving.	a thing that can be seen or touched	the goal of a game

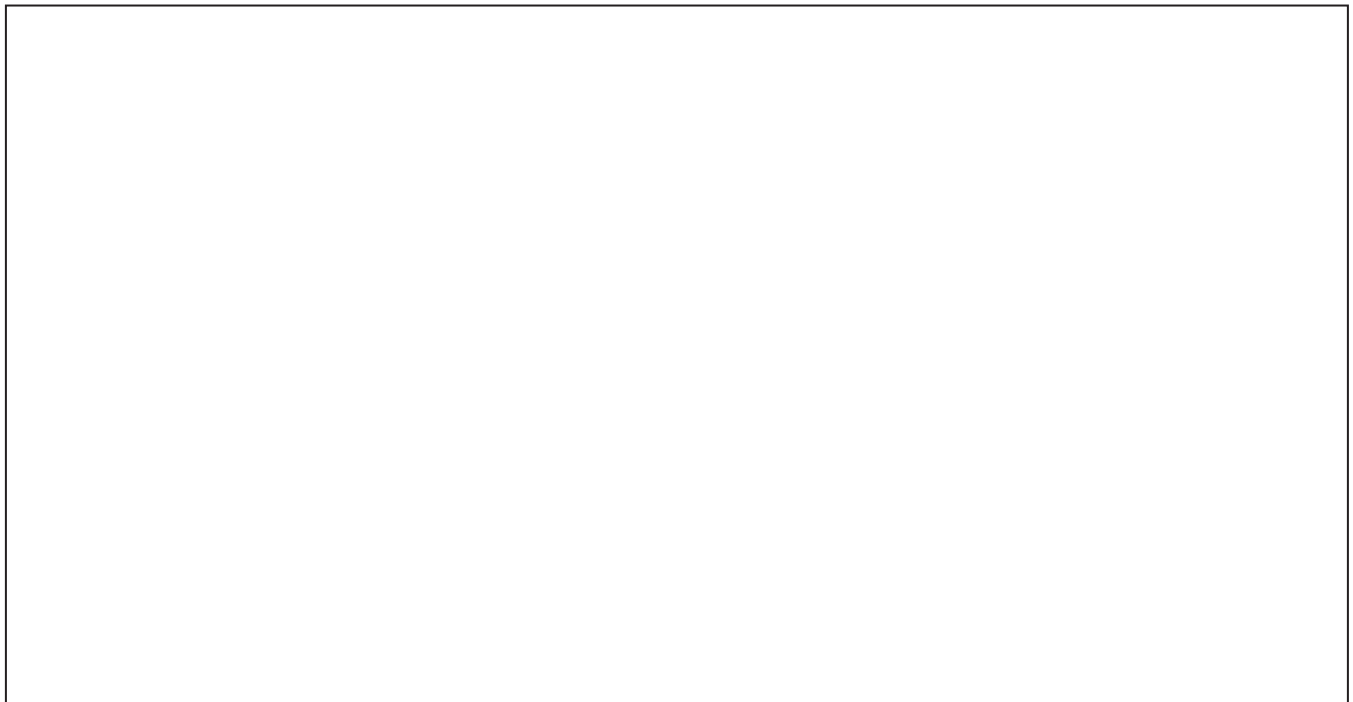
Name: _____ Date: _____

Daily Written Reflection

What is a force that could happen on a playground to make an object START moving?

What is a force that could happen on a playground to make an object STOP moving?

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

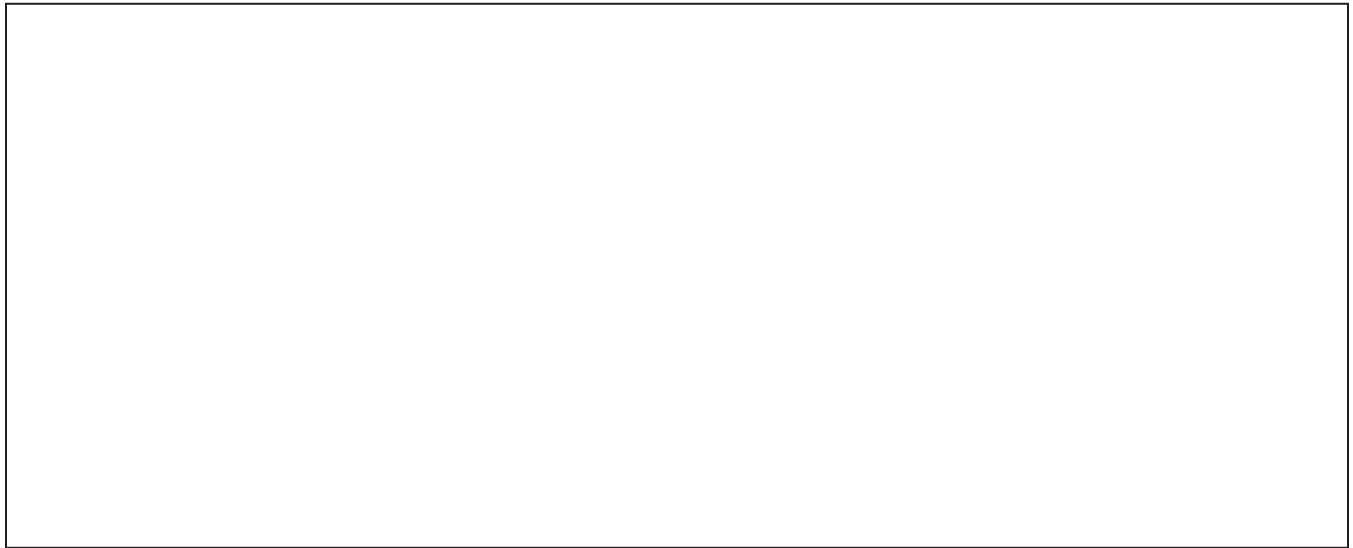


Name: _____ Date: _____

Forces in a Chain Reaction

Directions:

1. With your partner, set up and run chain reactions using materials from the bag.
2. Pick one chain reaction you made.
3. Make a drawing to show what happened in the chain reaction.



4. Choose two forces in your chain reaction and fill in information about them.
What were the two objects that the force acted between?
What was your evidence? How did you know a force happened?

Force #1

Object 1	Object 2	Evidence of a force

Force #2

Object 1	Object 2	Evidence of a force

Name: _____ Date: _____

What Is a Scientific Explanation?

1. It answers a question about how or why something happens.
2. It is based on the ideas you have learned from investigations and text.
3. It uses scientific language.
4. It is written for an audience.
5. It describes things that are not easy to observe.

Name: _____ Date: _____

Scientific Explanation of Why the Train Rises

Directions:

1. Write a scientific explanation that answers the question below.
2. Your audience is the people of Faraday.

Why does the train rise?

The train rises because _____

Name: _____ Date: _____

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

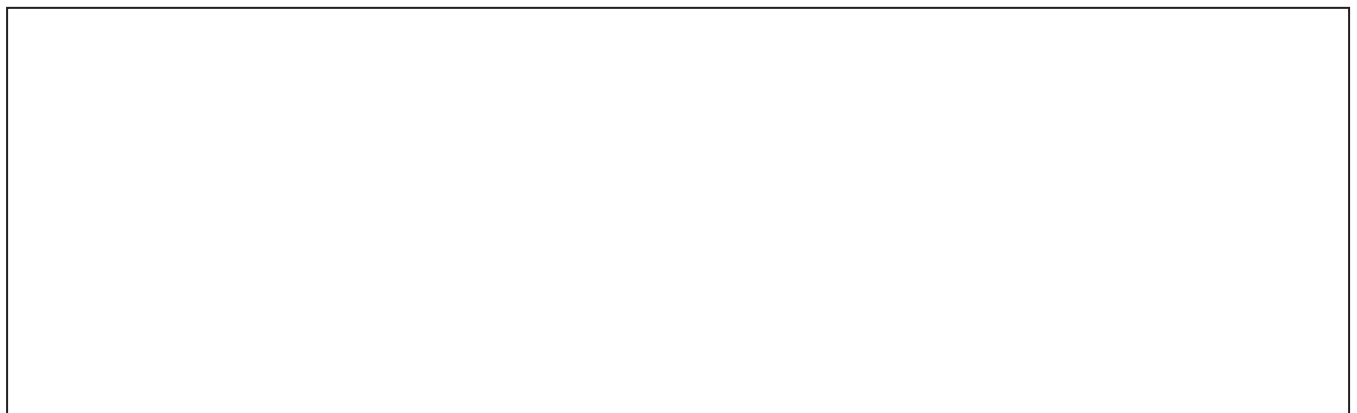
I understand why the train floats. _____ Yes _____ Not yet

I understand why the train changes from floating to falling. _____ Yes _____ Not yet

I understand that scientific explanations can change when there is new evidence. _____ 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.

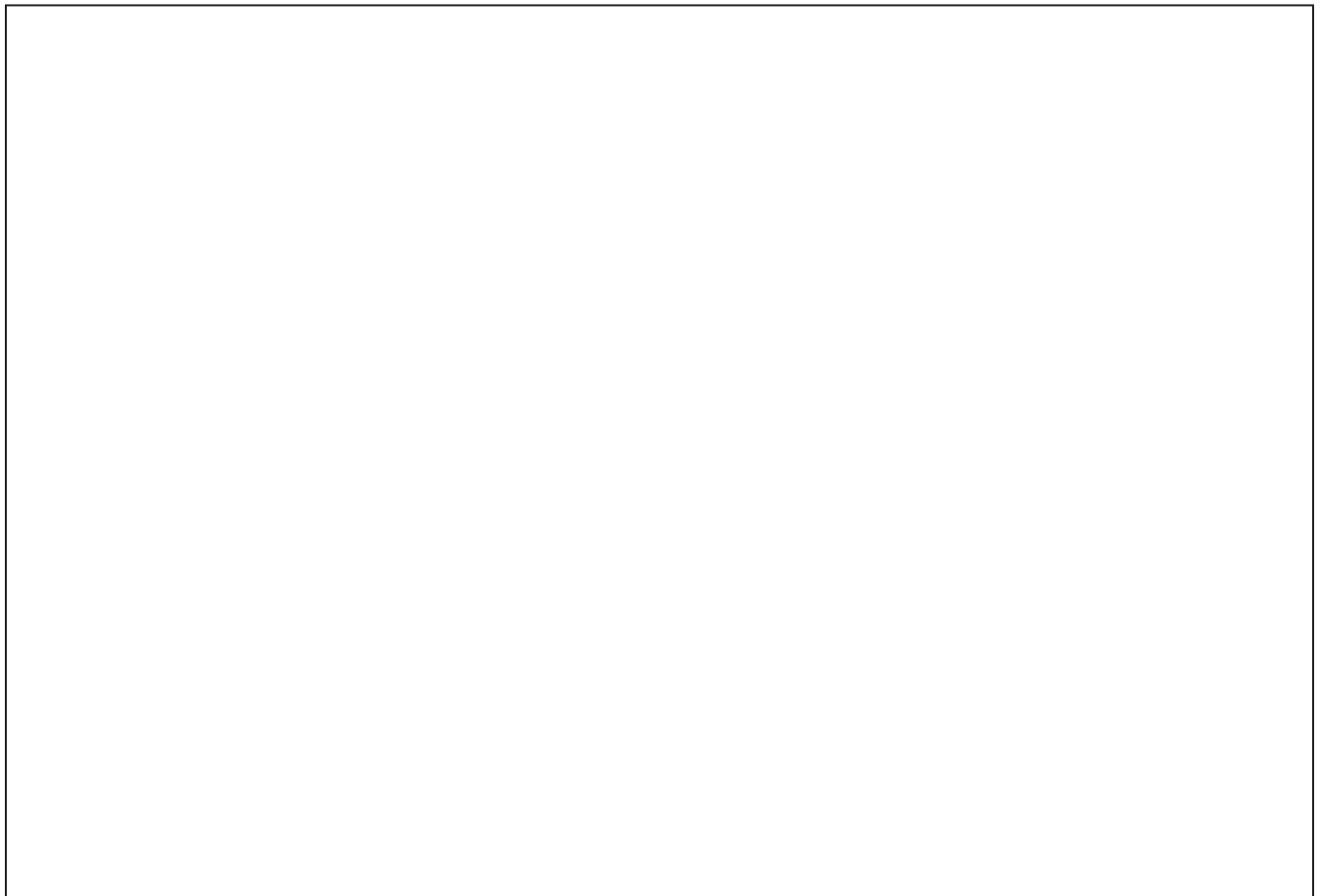


Name: _____ Date: _____

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.



Name: _____ Date: _____

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? _____

Word Bank					
force	magnet	changed	push	pull	rolled
touching force	non-touching force	slid	moved	started	
stopped	jumped	When I . . .	I observed that . . .		

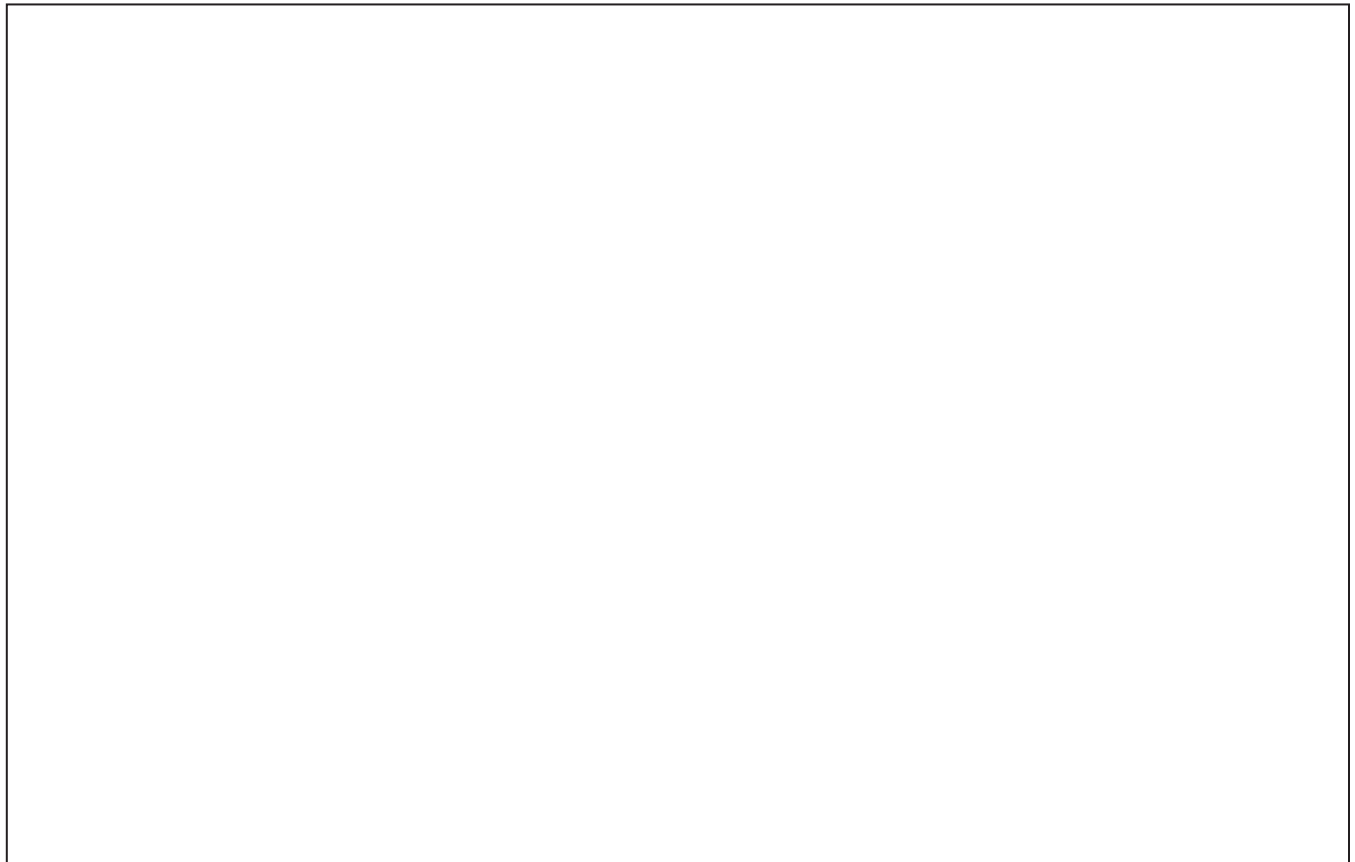
What is your evidence? _____

Name: _____ Date: _____

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 Objects Do Magnetic Forces Act On?

Directions:

1. For each row, predict whether a magnetic force will act on Object 2.
2. Once you receive your magnet, test your predictions. Record your test results in the last column.
3. Repeat the process for the objects in the table on the next page.

Object 1	Object 2	Is Object 2 metal?	Prediction: Do you think magnetic force will act on Object 2?	Test: Did magnetic force act on Object 2?
magnet	washer	yes		
magnet	wood	no		
magnet	penny	yes		
magnet	paper clip	yes		
magnet	fastener 1	yes		
magnet	fastener 2	yes		

Predict and Test: What Objects Do Magnetic Forces Act On? (continued)

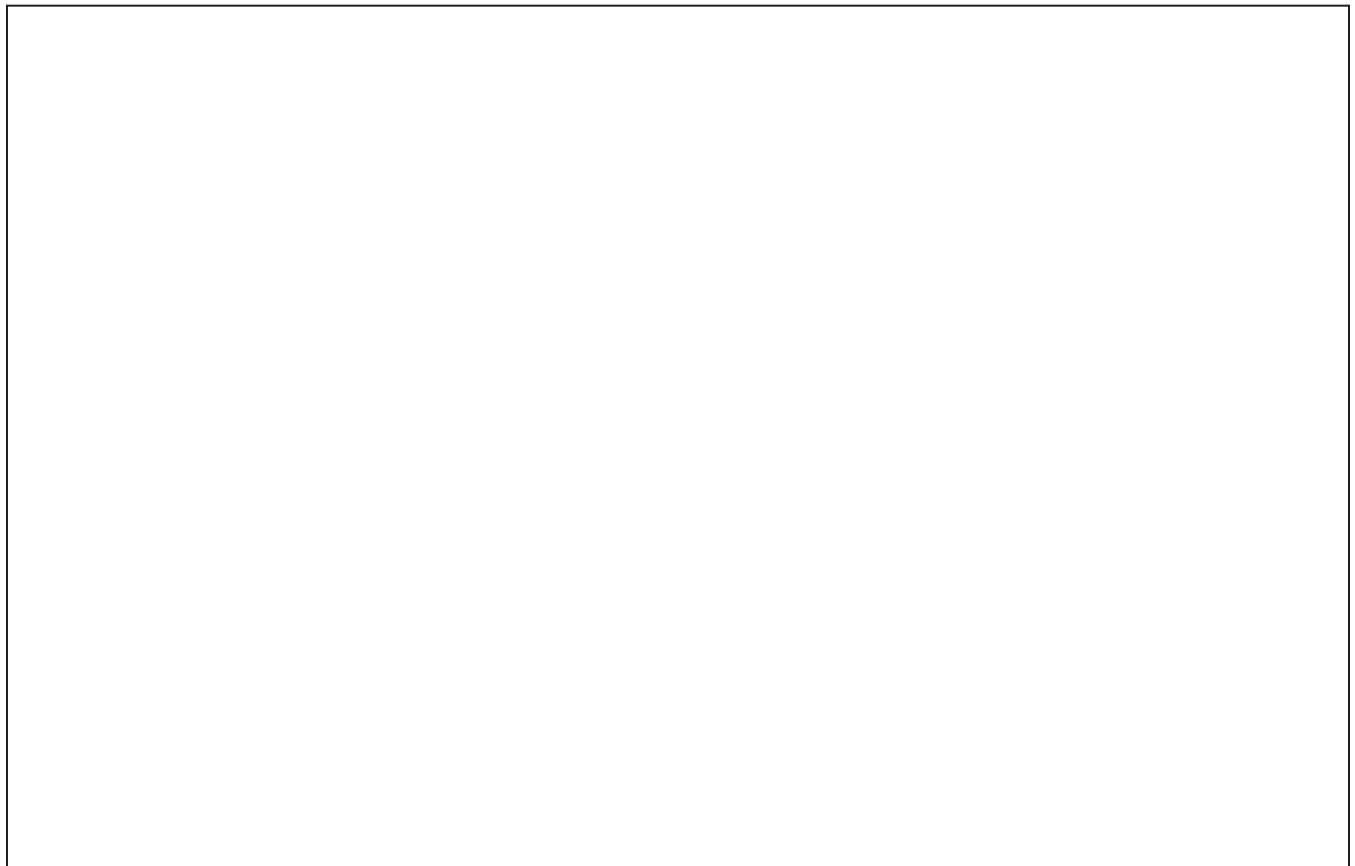
Object 1	Object 2	Is Object 2 metal?	Prediction: Do you think magnetic force will act on Object 2?	Test: Did magnetic force act on Object 2?
magnet	foil	yes		
magnet	twist tie	partly		
magnet	spoon 1	yes		
magnet	spoon 2	no		
magnet	balloon	no		
magnet	steel wool	yes		

Name: _____ Date: _____

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.



Name: _____ Date: _____


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.

Word Bank			
attract	exert	magnet	magnetic force
	evidence	change	repel

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

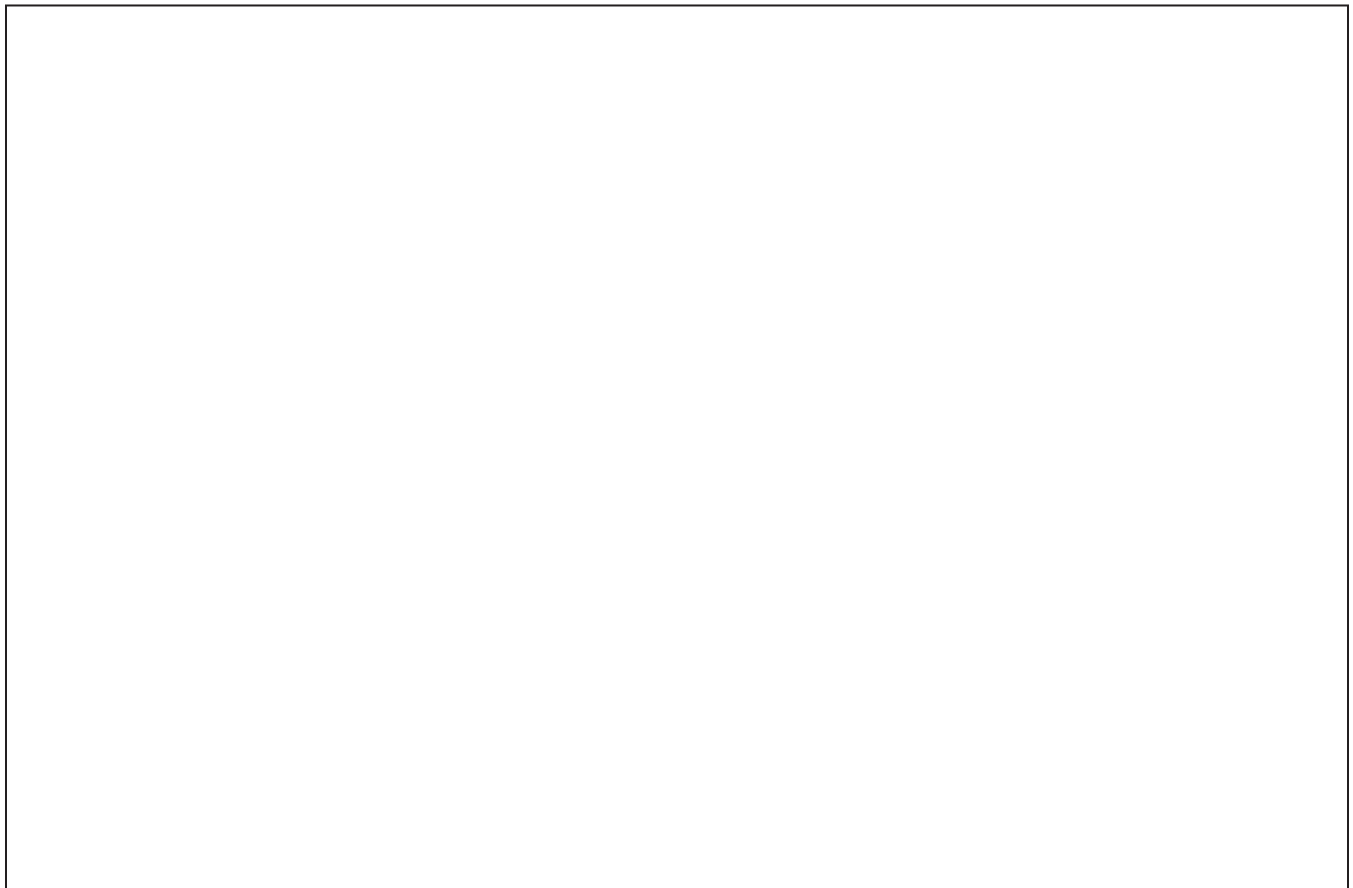


Name: _____ Date: _____

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:

1. Before reading the book **What My Sister Taught Me About Magnets**, 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.

_____ 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.

Explanation 1: page 7	
Explanation 2: pages 10-11	
Explanation 3: page 16	

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.

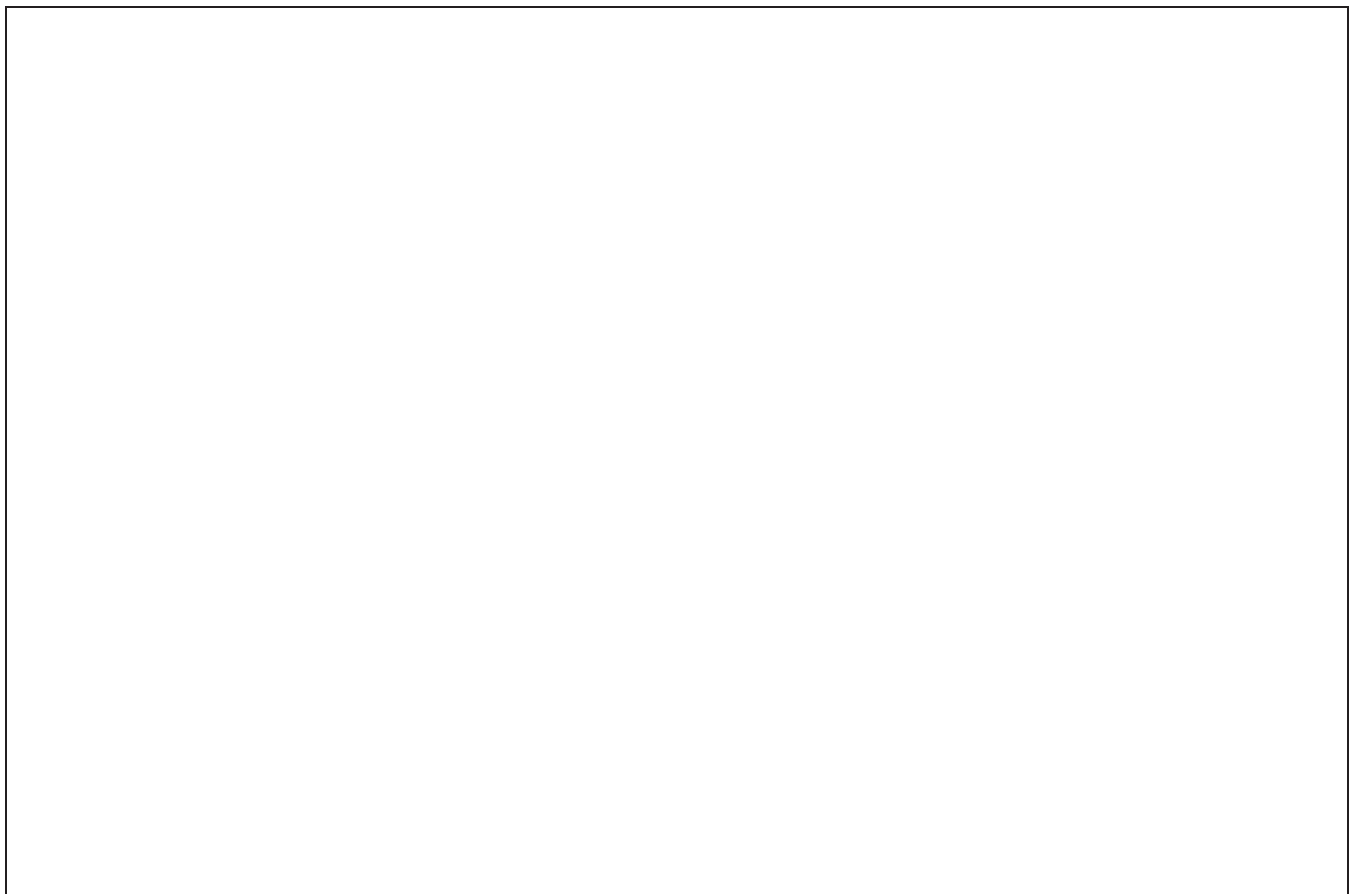
Word	Sentence from the book	Meaning 1	Meaning 2
pole	Every magnet has two poles , north and south.	the part of a magnet that pushes or pulls	a long, thin object
kind	What kind of metal?	nice or friendly	type or sort
iron	Steel is mostly made of iron .	a type of metal	a tool for getting rid of wrinkles in clothes
table	Here is the table my sister made to record what we found out.	a kind of furniture	a way of recording information by using words and numbers inside lines and boxes

Name: _____ Date: _____

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.



Name: _____ Date: _____

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. Record several of the sentences you created.

1. _____

2. _____

3. _____

4. _____

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



Name: _____ Date: _____

Scientific Explanation of Why the Train Rises Without Anything Touching It

Directions:

1. Write an explanation that answers the question below.
2. Your audience is the people of Faraday.

Why does the train rise without anything touching it?

Name: _____ Date: _____

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 changes from floating to falling. _____ Yes _____ Not yet

I understand that scientific explanations can change when there is new evidence. _____ 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.

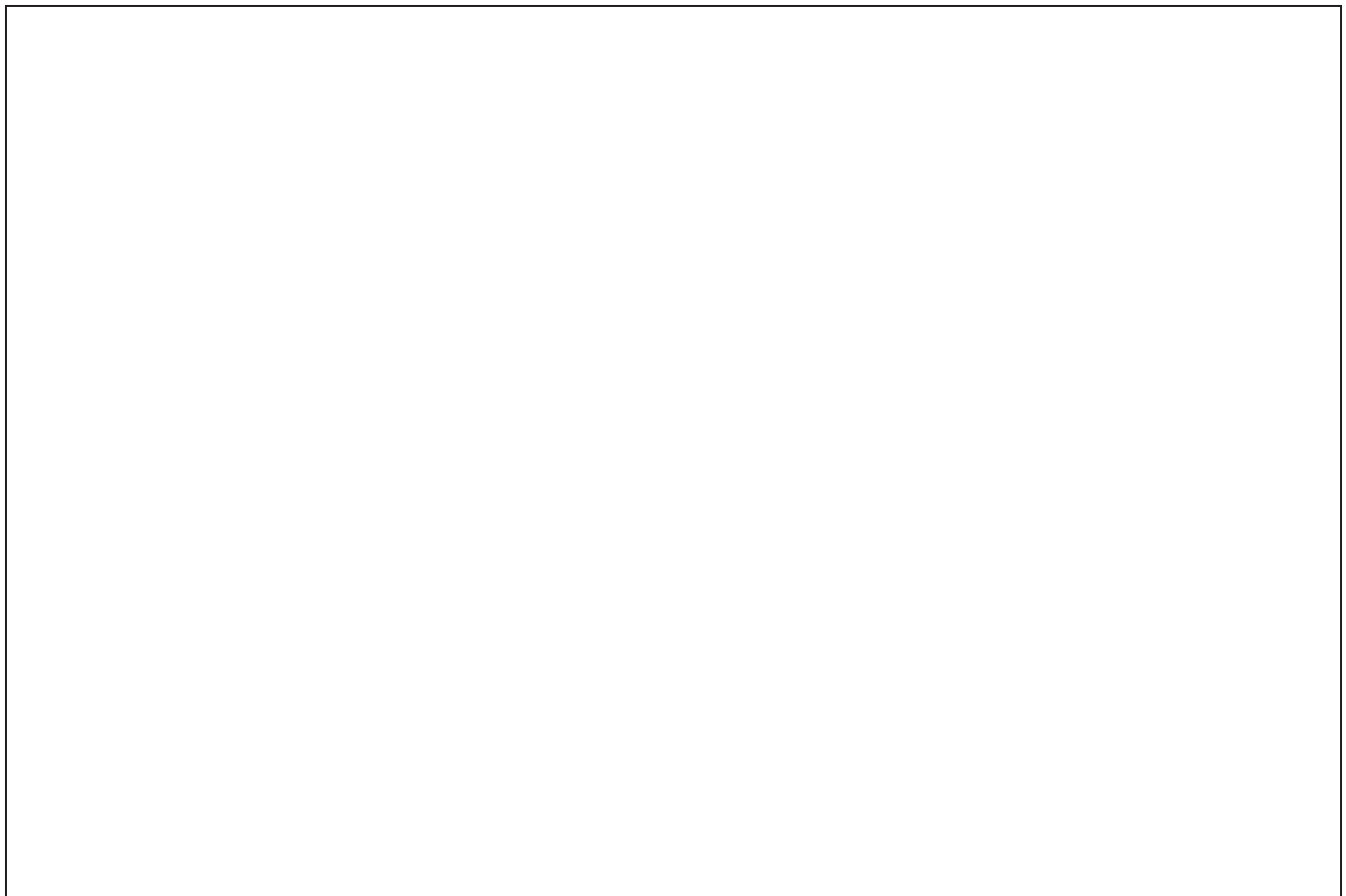


Name: _____ Date: _____

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.



Name: _____ Date: _____

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:

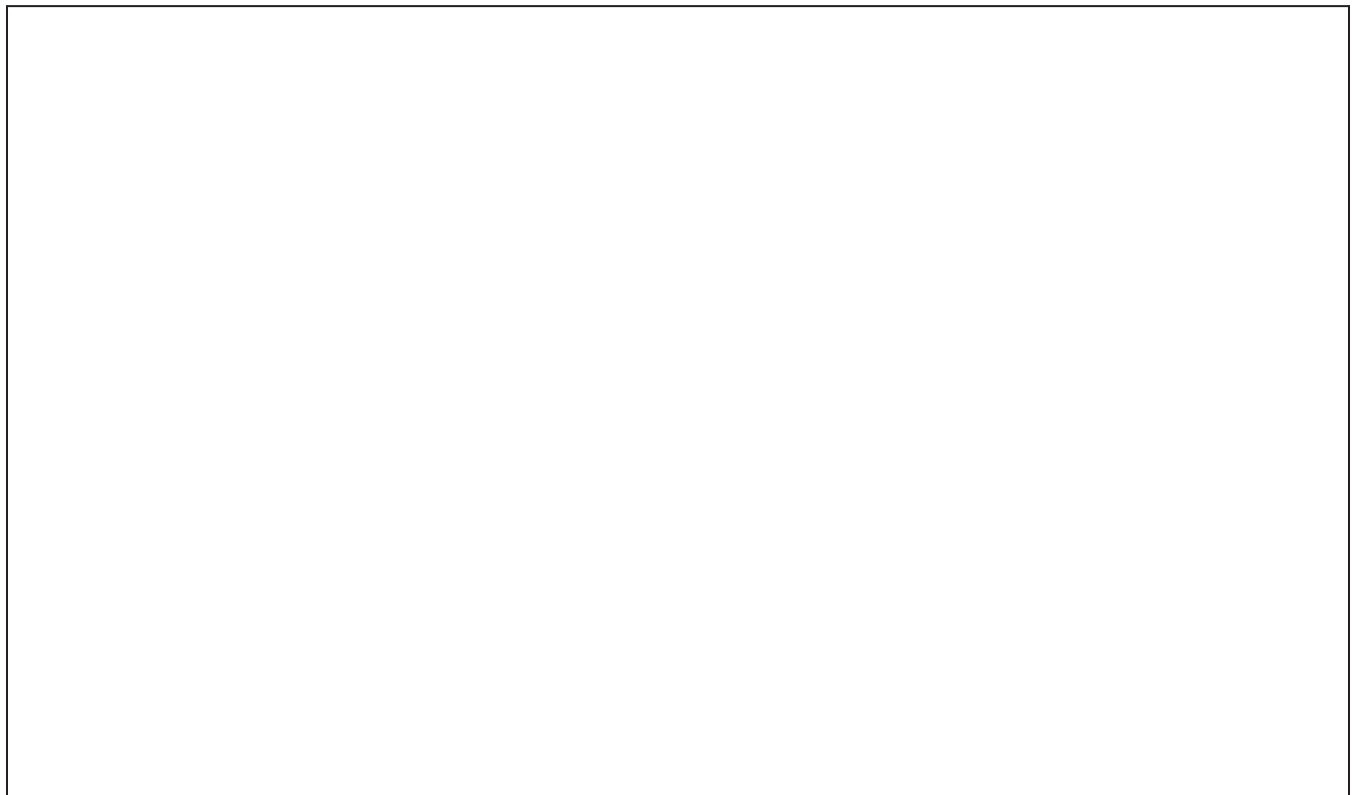
Observations from my sense of touch:

Name: _____ Date: _____

Daily Written Reflection

We saw evidence that gravity could make an object start moving. Do you think gravity could also make an object STOP moving? Why or why not? Don't worry if you aren't sure of your answer.

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

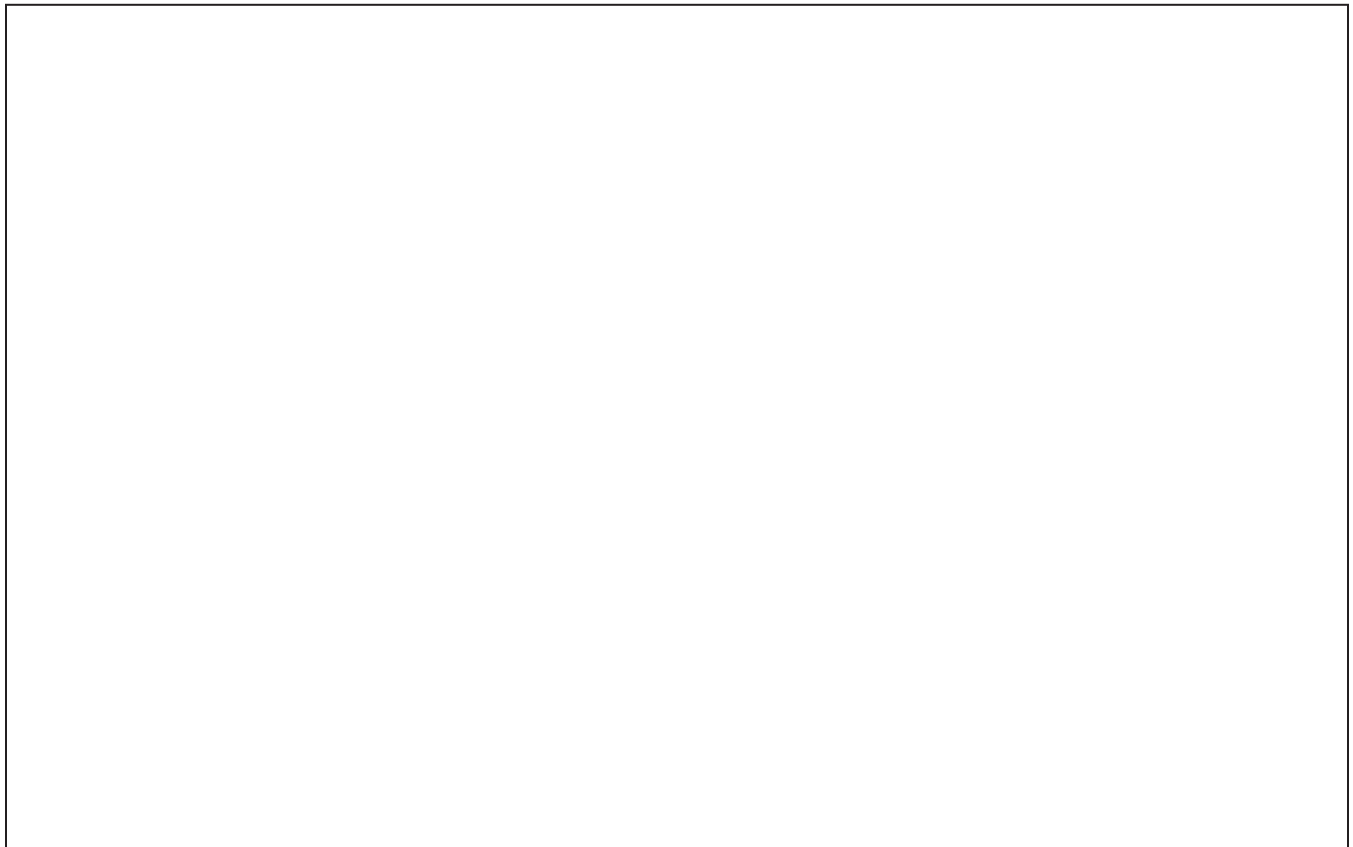


Name: _____ Date: _____

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.



Name: _____ Date: _____

Reading About Gravity: My Purpose for Reading

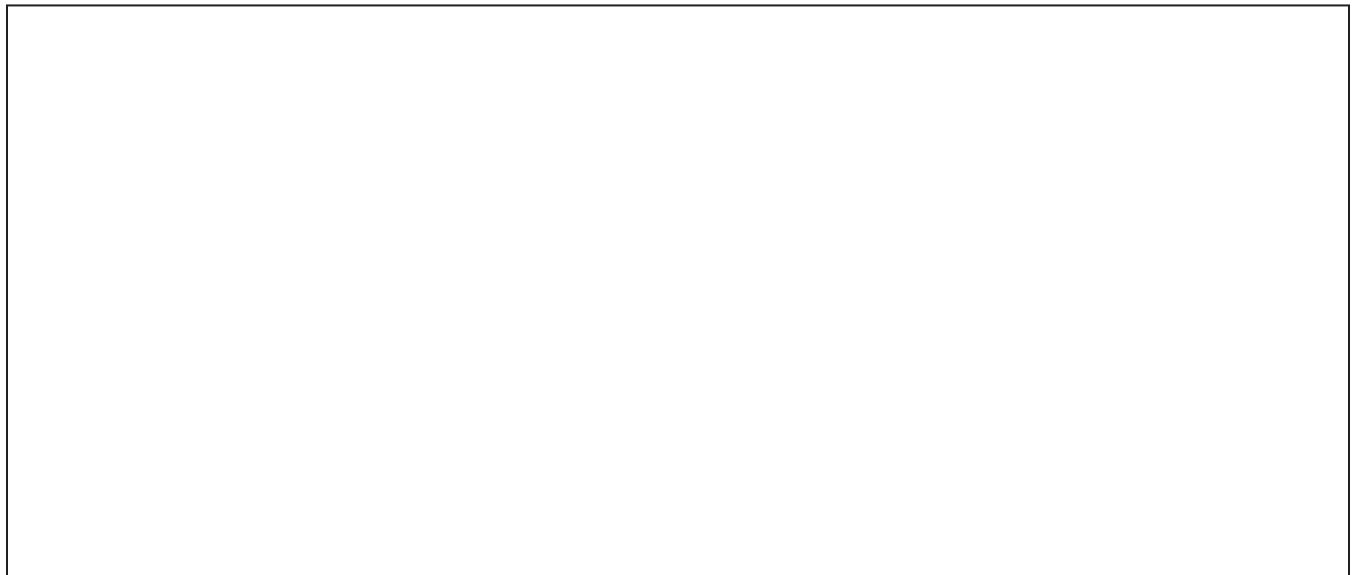
Directions:

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.

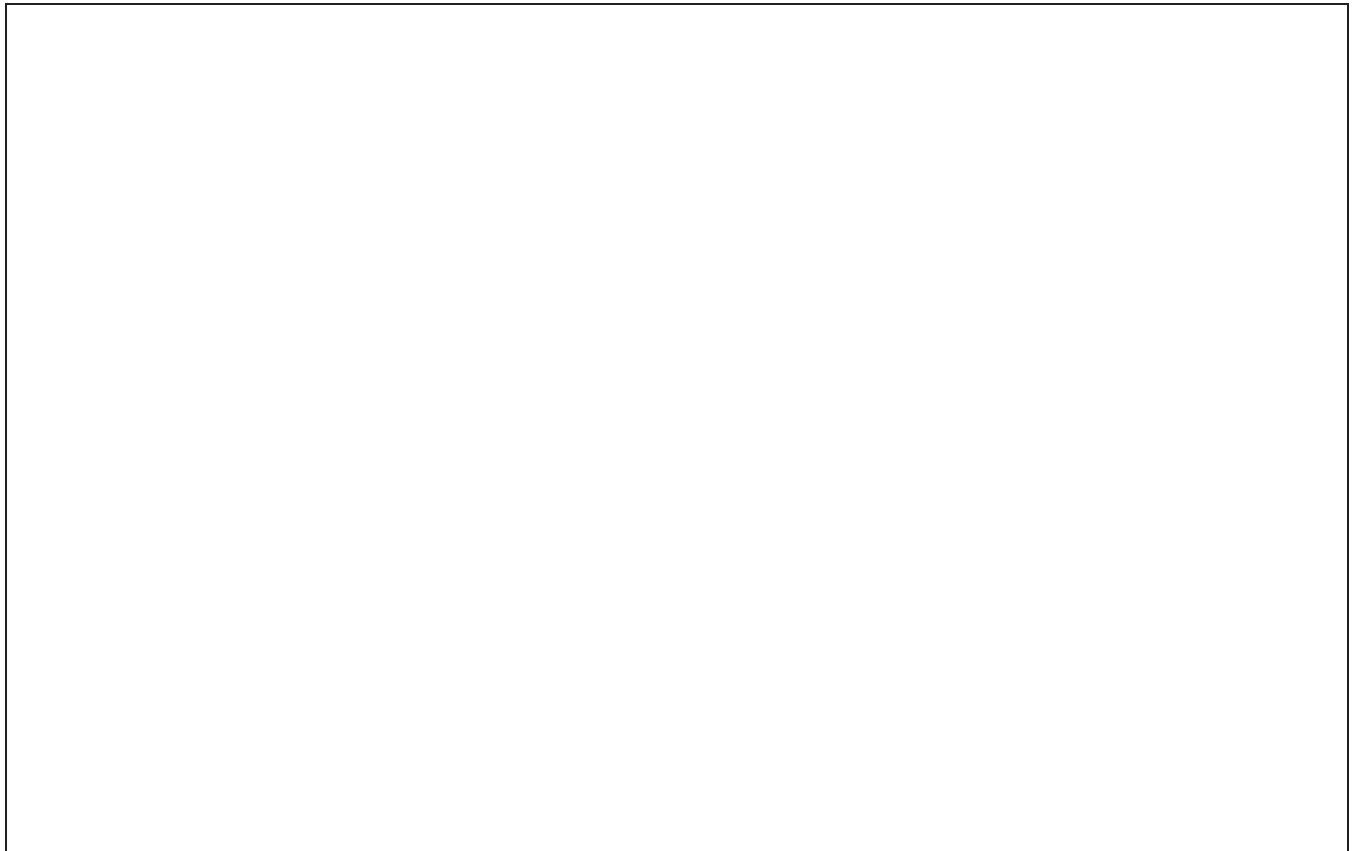


Name: _____ Date: _____

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.

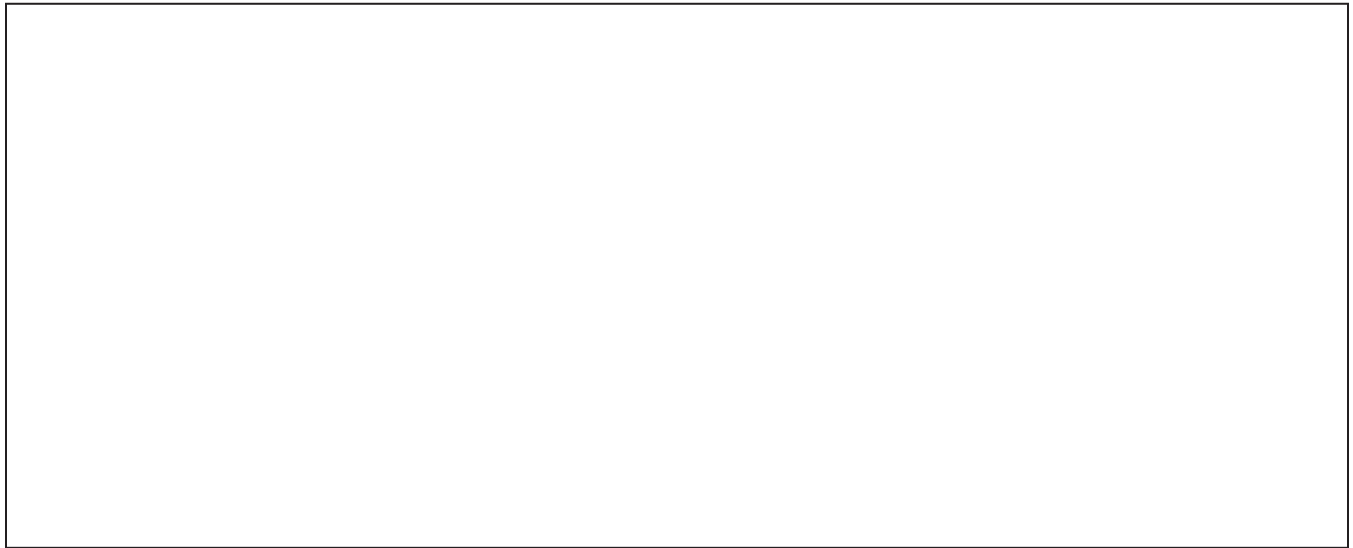


Name: _____ Date: _____

Different Forces in a Chain Reaction

Directions:

1. Work with your partner to make a chain reaction.
2. Include at least one touching force, one magnetic force, and one example of the force of gravity.
3. Draw a diagram of your chain reaction.



4. Fill out the table for three of the forces in your chain reaction.

Object 1	Object 2	Evidence of a force	Type of force (circle one)
			Touching force Magnetic force Gravity
			Touching force Magnetic force Gravity
			Touching force Magnetic force Gravity

Name: _____ Date: _____

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 how gravity and magnetic force are the same or different.
3. Record several of the sentences you created.

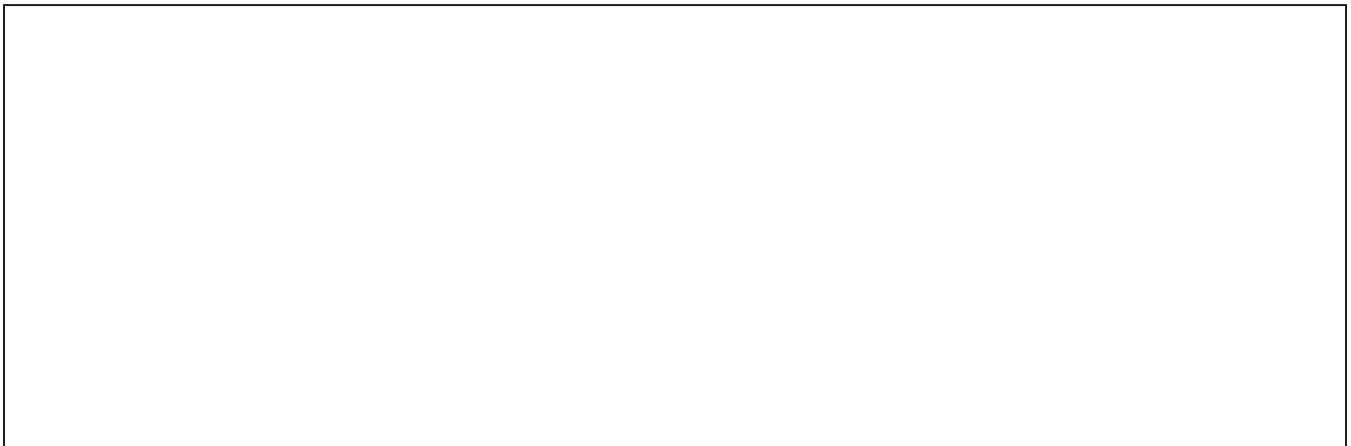
1. _____

2. _____

3. _____

4. _____

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

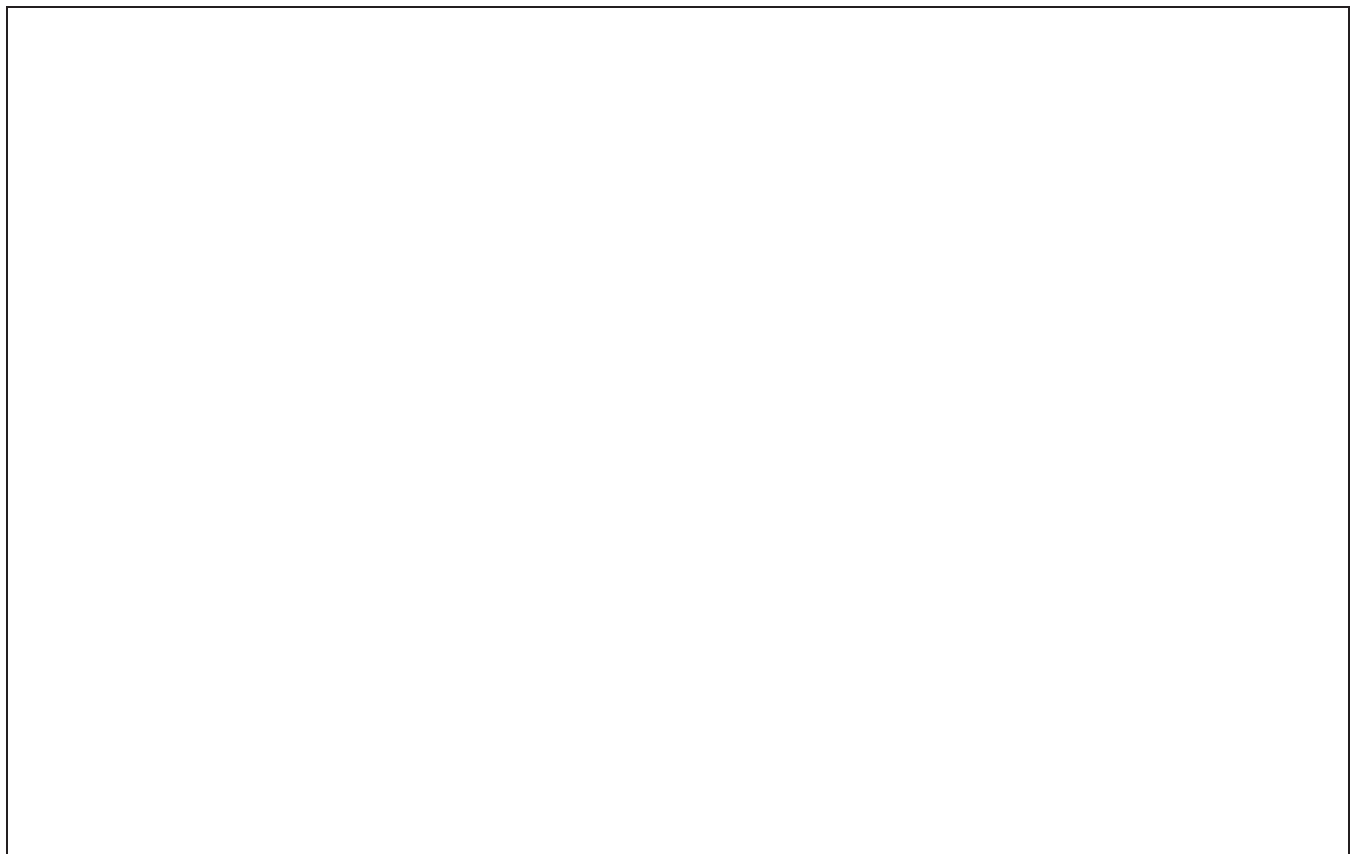


Name: _____ Date: _____

Daily Written Reflection

What questions do you still have about gravity? Which of your questions do you think you could try to figure out with an investigation?

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



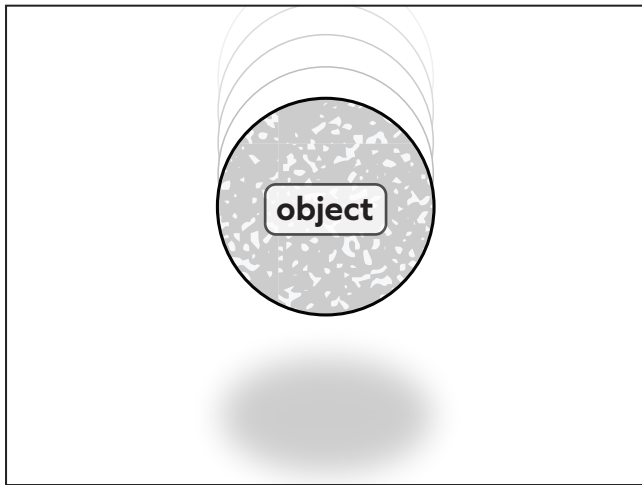
Diagramming Forces

Directions:

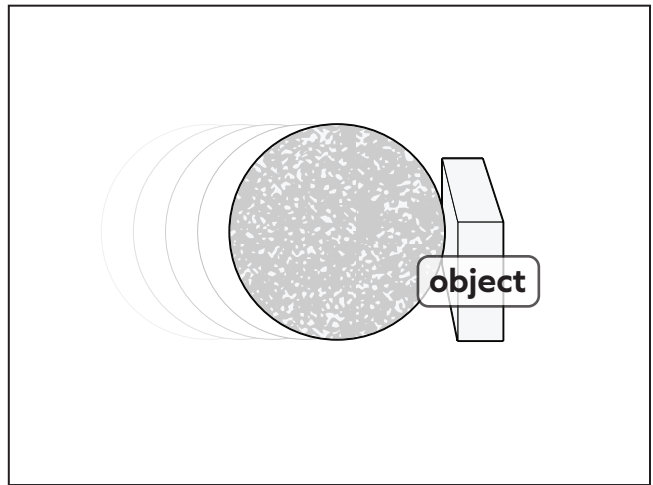
1. In each box, draw an arrow to show the direction of the force on the object that has the object label.
2. Add labels to the diagram, using words from the Word Bank.

Word Bank				
push	pull	attract	repel	gravity
touching force		magnetic force		

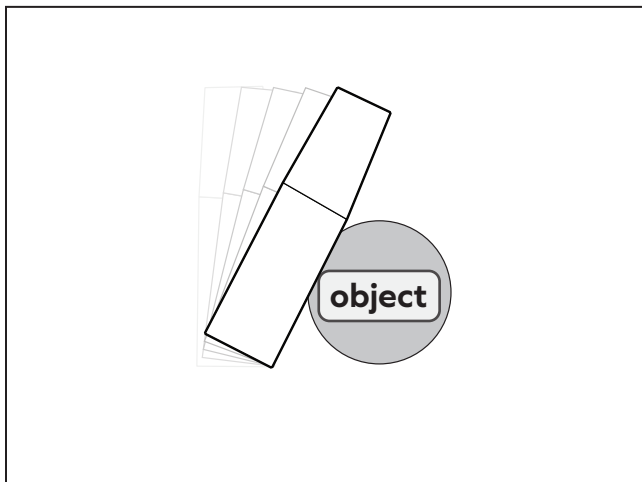
Falling ball



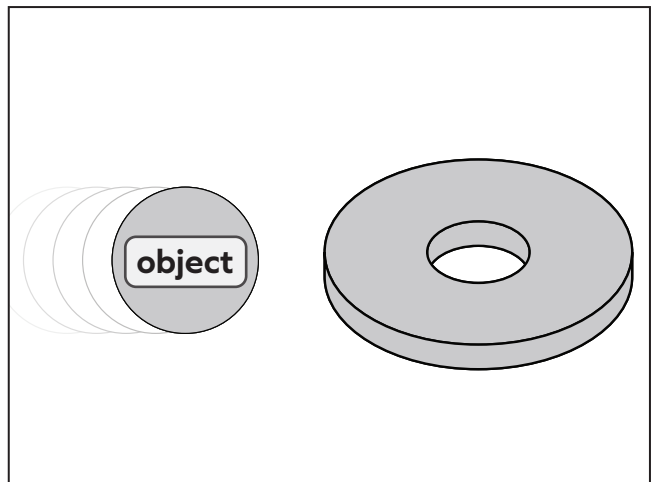
Ball hitting domino



Domino hitting ball magnet



Ball magnet moving toward ring magnet



Name: _____ Date: _____

Scientific Explanation of Why the Train Falls

Directions:

1. Write an explanation that answers the question below.
2. Your audience is the people of Faraday.

Why does the train fall?

Name: _____ Date: _____

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

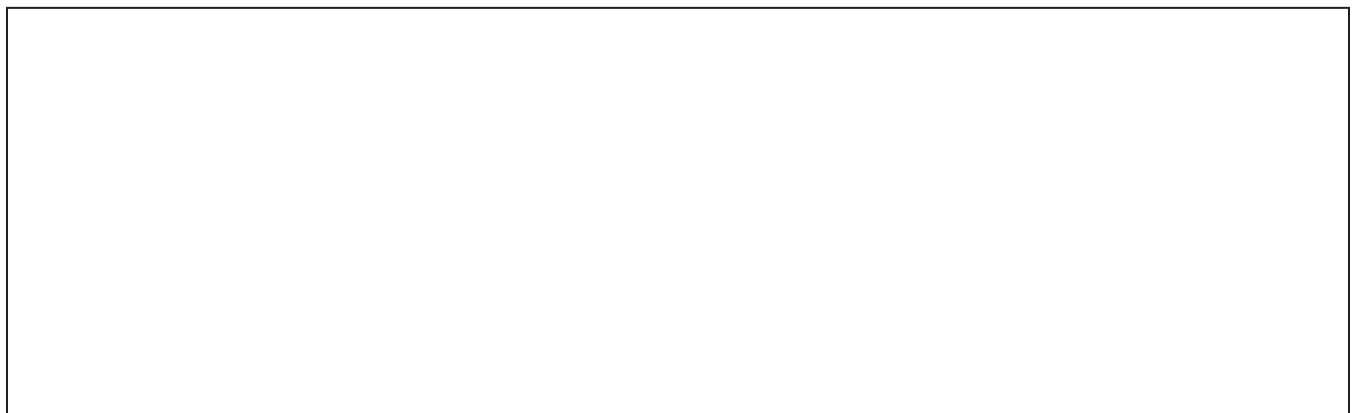
I understand why the train floats. _____ Yes _____ Not yet

I understand why the train changes from floating to falling. _____ Yes _____ Not yet

I understand that scientific explanations can change when there is new evidence. _____ 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.

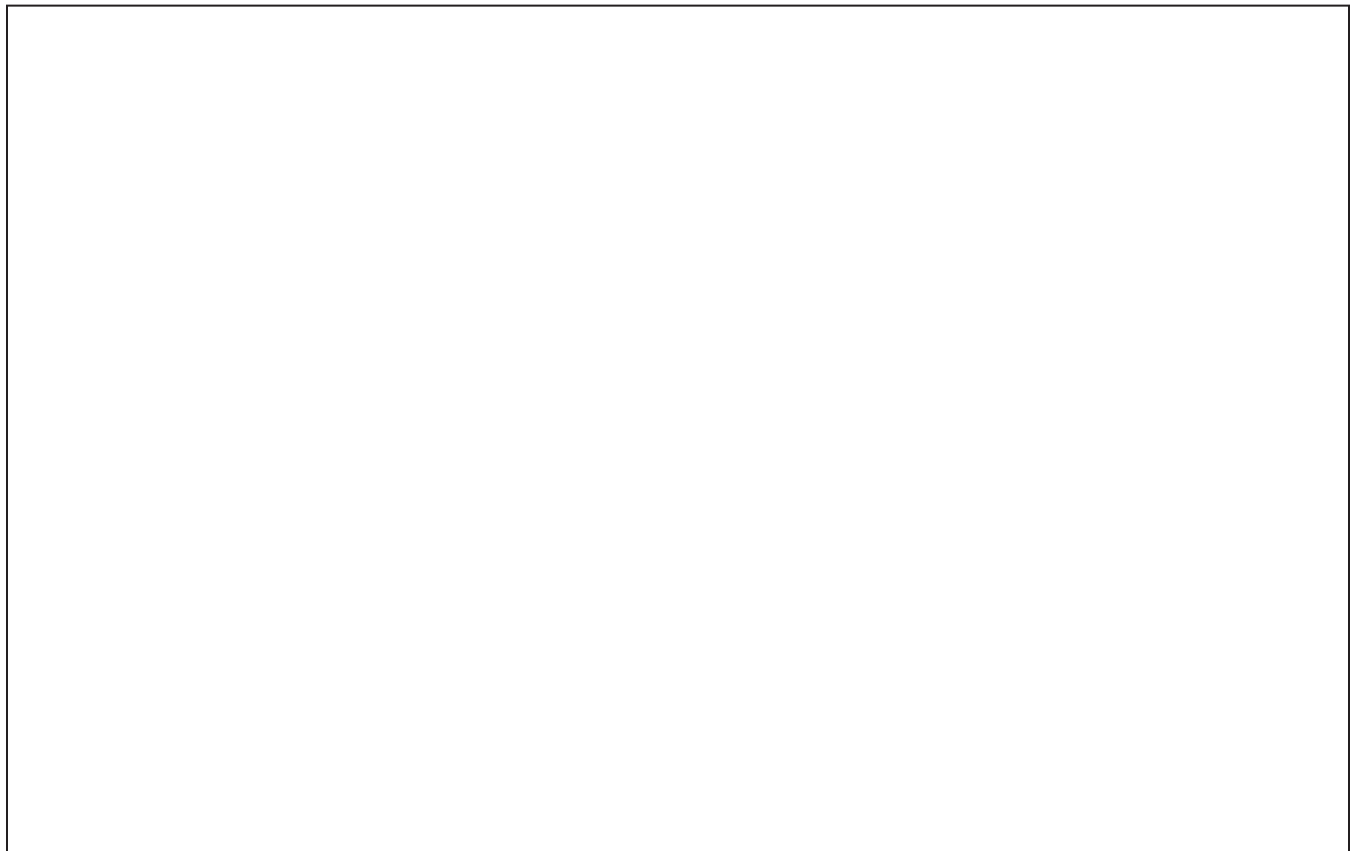


Name: _____ Date: _____

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.



Name: _____ Date: _____

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? _____

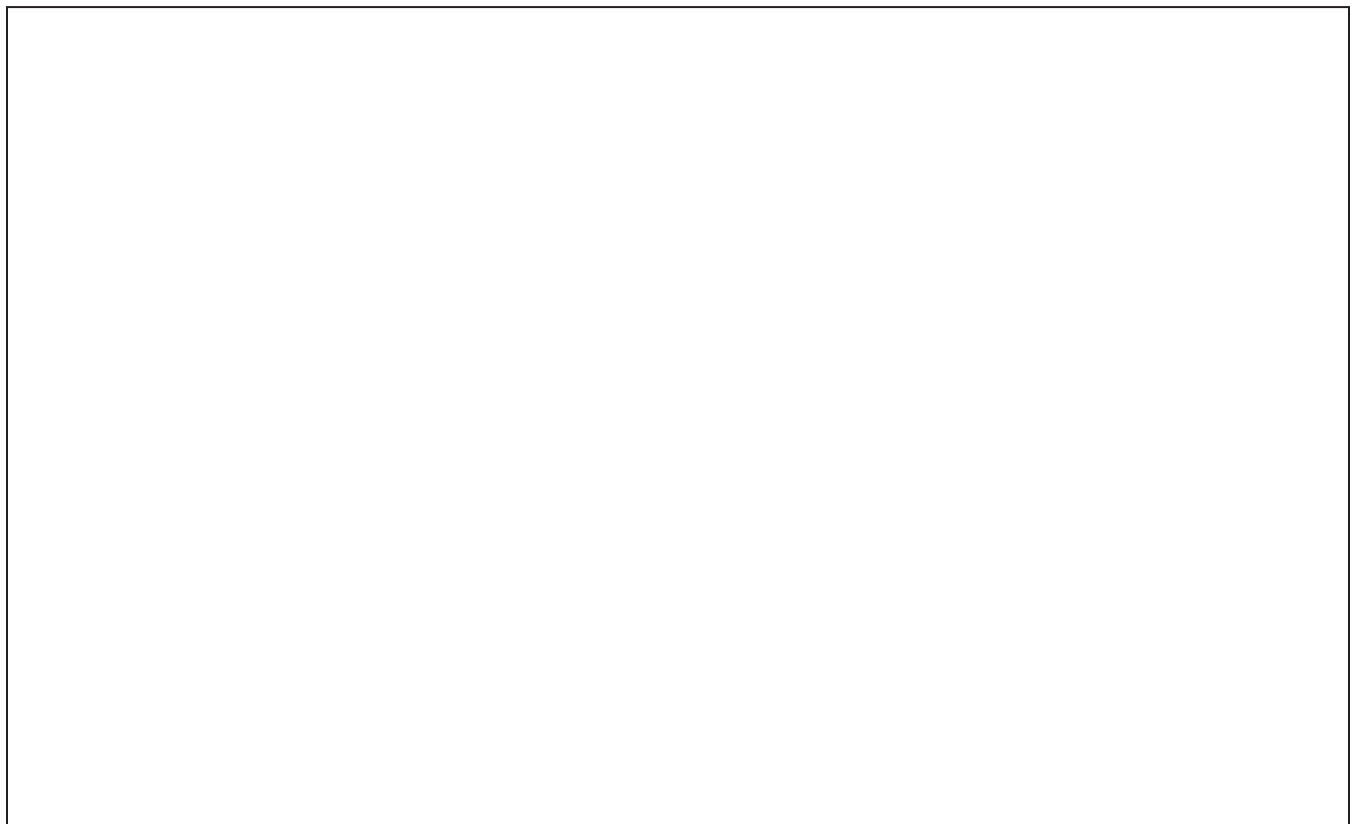
Changes or additions I want to make to my answers:

Name: _____ Date: _____

Two Forces Exerted at Once

What evidence did you observe that shows two forces can be exerted on an object at once?

Make a drawing to show an example you observed of two forces exerted on an object at once. Label your drawing.

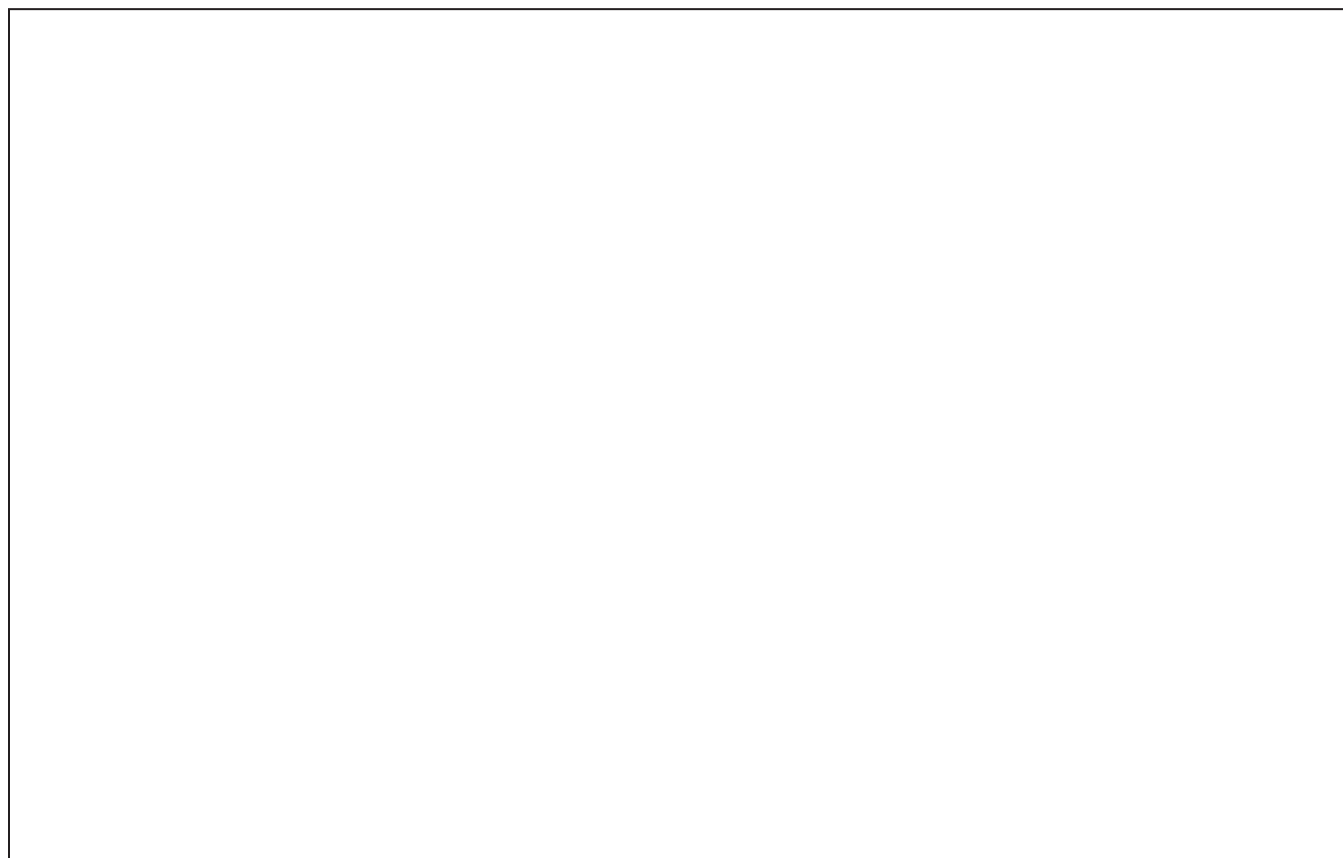


Name: _____ Date: _____

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.



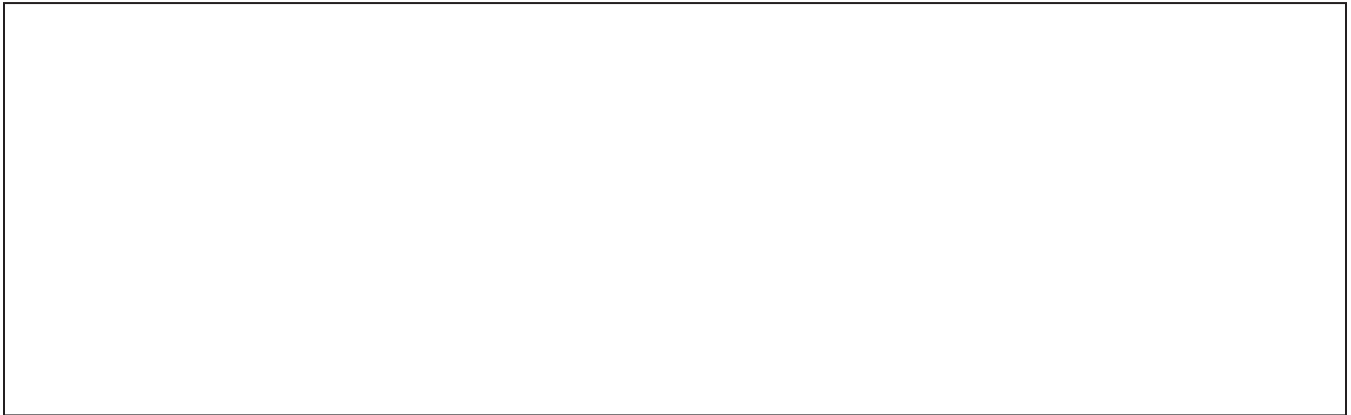
Name: _____ Date: _____

Floating Paper Clip

Directions:

1. Draw a diagram to show how you made the paper clip float on the end of the string.
2. Under the diagram, record one force exerted on the paper clip and then record the two objects that the force is exerted between.
3. Record a second force exerted on the paper clip and then record the two objects the force is exerted between.

Diagram:



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 _____

Name: _____ Date: _____

Chapter 4: 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 are about balanced forces.
3. Record several of the sentences you created.

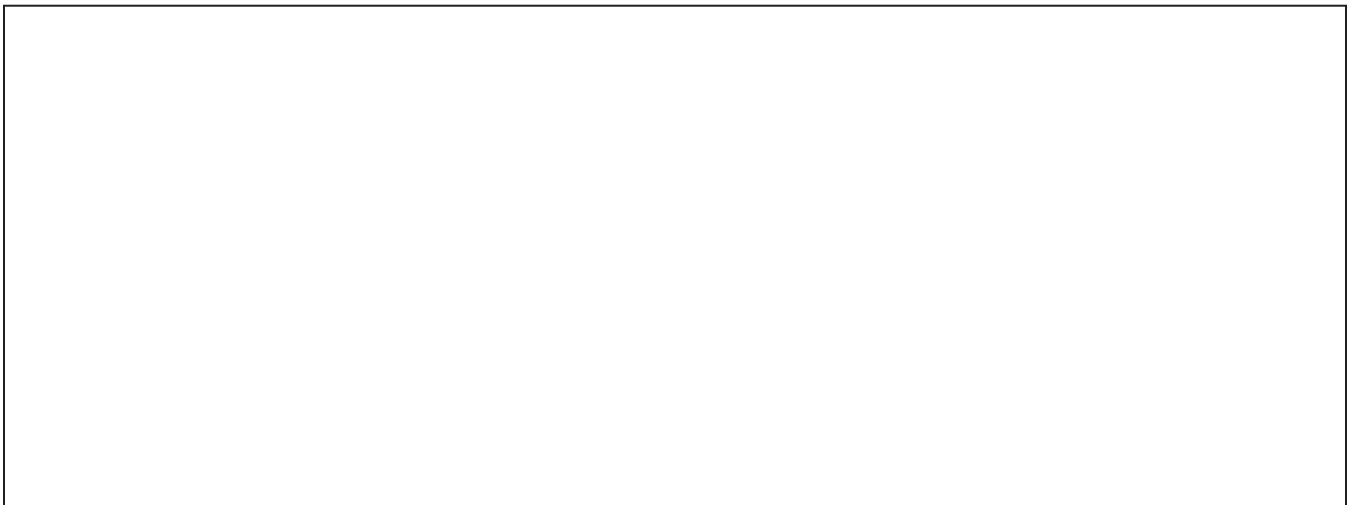
1. _____

2. _____

3. _____

4. _____

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



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.

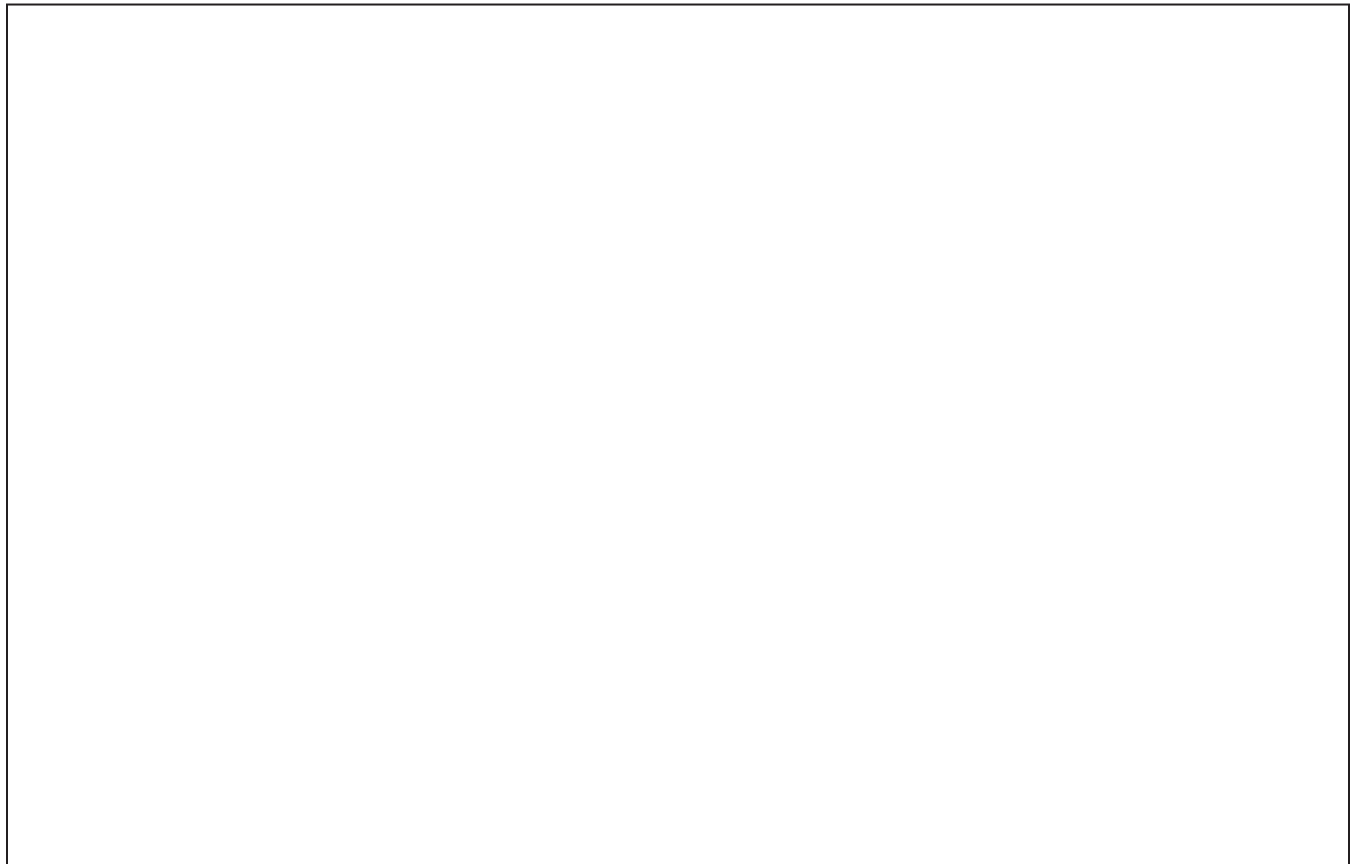
Word	Sentence from the book	Meaning 1	Meaning 2
multiple	The movement of the ball up and then down is evidence of multiple forces.	more than one	a number that can be made by multiplying a smaller number (for example, 6 is a multiple of 2)
acting	The multiple forces acting on an object can have different strengths.	having an effect	pretending to be someone else for a movie or play
table	The table pushes them up while Earth pulls them down.	a kind of furniture	a way of recording information by using words and numbers inside lines and boxes

Name: _____ Date: _____

Daily Written Reflection

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

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



Name: _____ Date: _____

Setting a Purpose for Reading Explaining a Bridge

Directions:

1. Discuss with your partner and decide on a purpose for reading **Explaining a Bridge**.
2. Check to make sure that your purpose will help you explain to the people of Faraday why the train floats even though gravity is acting on it.
3. Read **Explaining a Bridge** and mark places in the book that have to do with your reading purpose.
4. Write notes about what you found in the book.

Reading purpose: To learn more about _____

Notes about what you read that has to do with your reading purpose:

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.

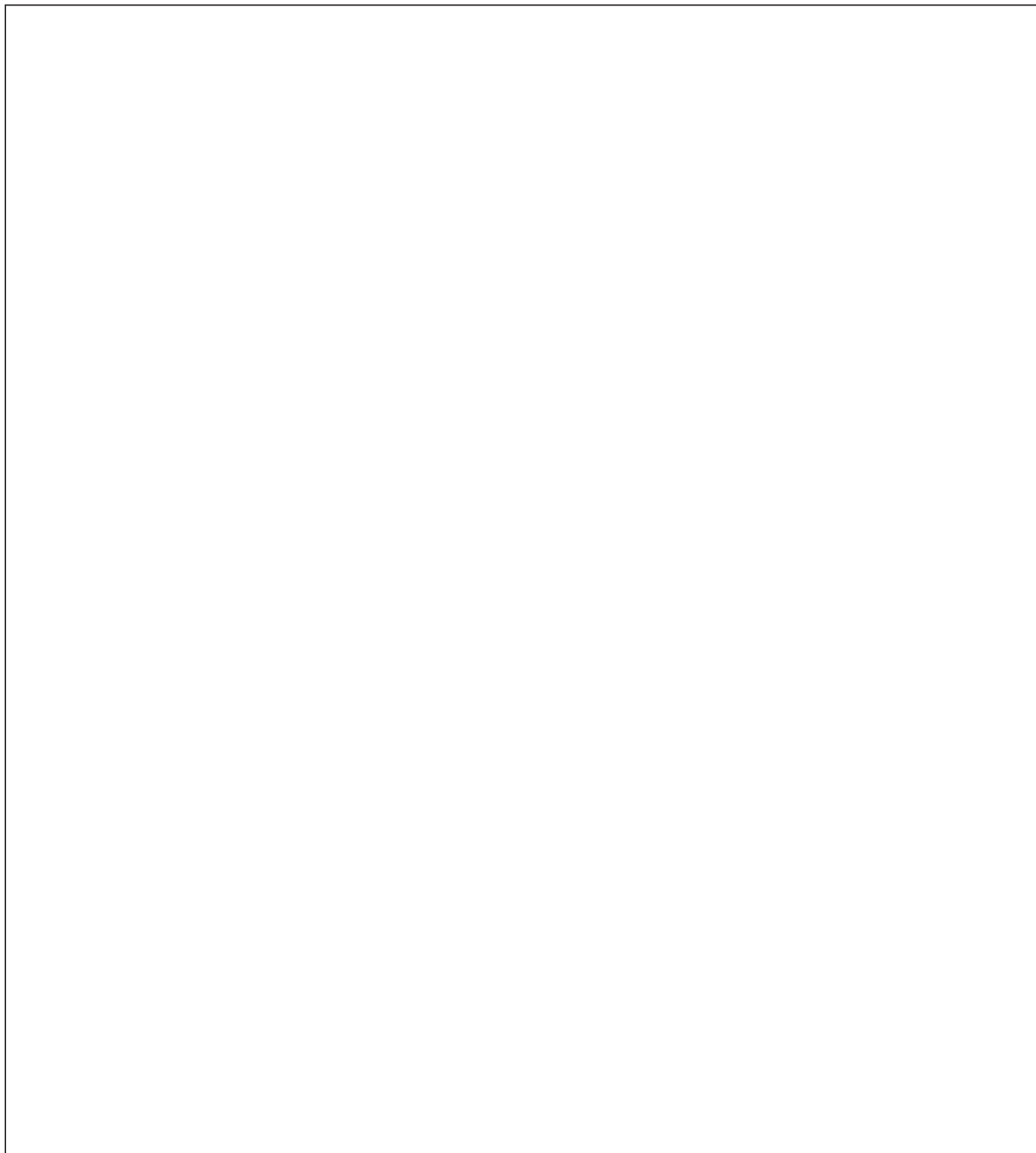
_____ All bridges have the same basic shape.

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

Name: _____ Date: _____

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.

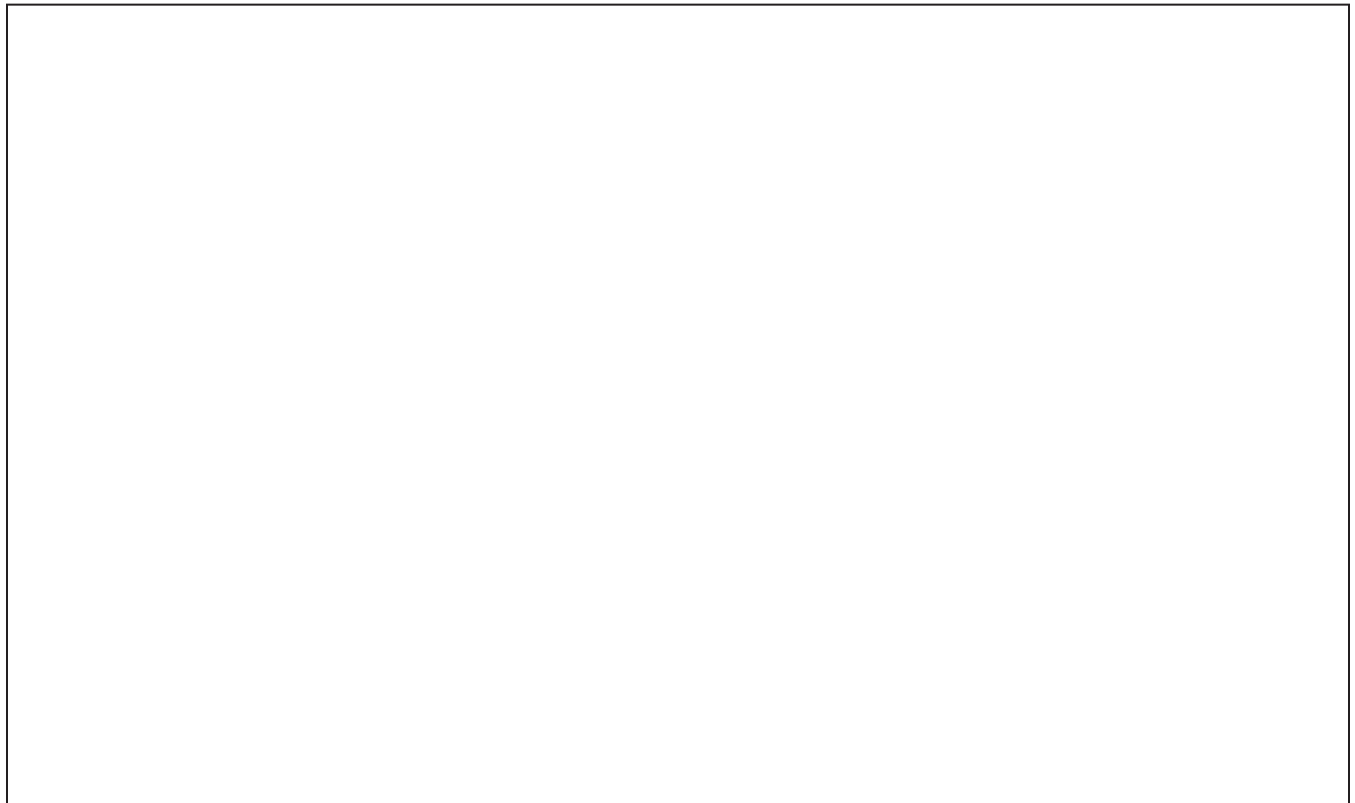
Word	Sentence from the book	Meaning 1	Meaning 2
fall	That makes some people afraid that the new bridge could fall .	drop down	autumn, a season
engineer	Maroney is one of the engineers who helped design the new Bay Bridge.	someone who drives a train	someone who uses scientific knowledge to design something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

Name: _____ Date: _____

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.



Name: _____ Date: _____

Scientific Explanation of Why the Train Floats

Directions:

1. Write an explanation that answers the question below.
2. Your audience is the people of Faraday.

Why does the train float, even though gravity is acting on it?

Name: _____ Date: _____

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

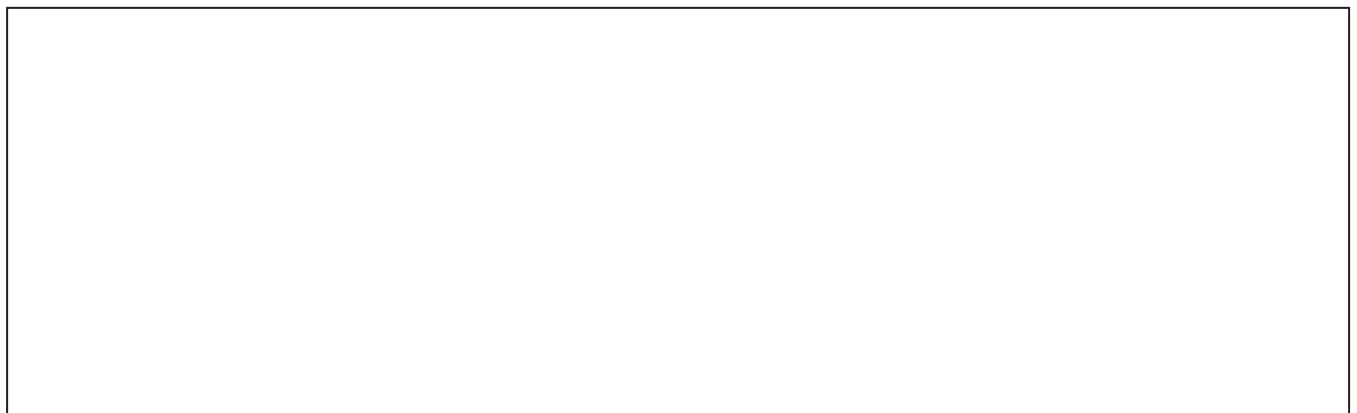
I understand why the train floats. _____ Yes _____ Not yet

I understand why the train changes from floating to falling. _____ Yes _____ Not yet

I understand that scientific explanations can change when there is new evidence. _____ 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.

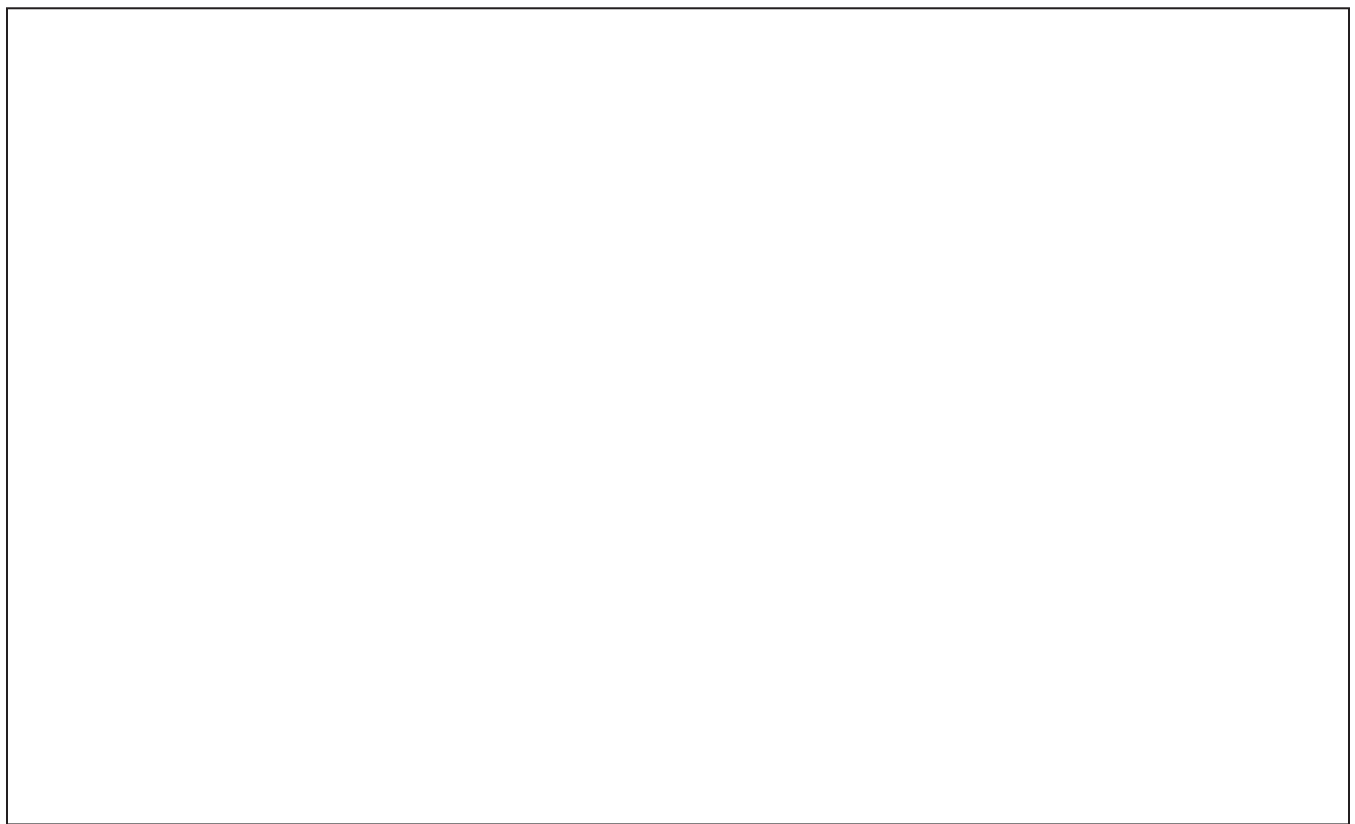


Name: _____ Date: _____

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.

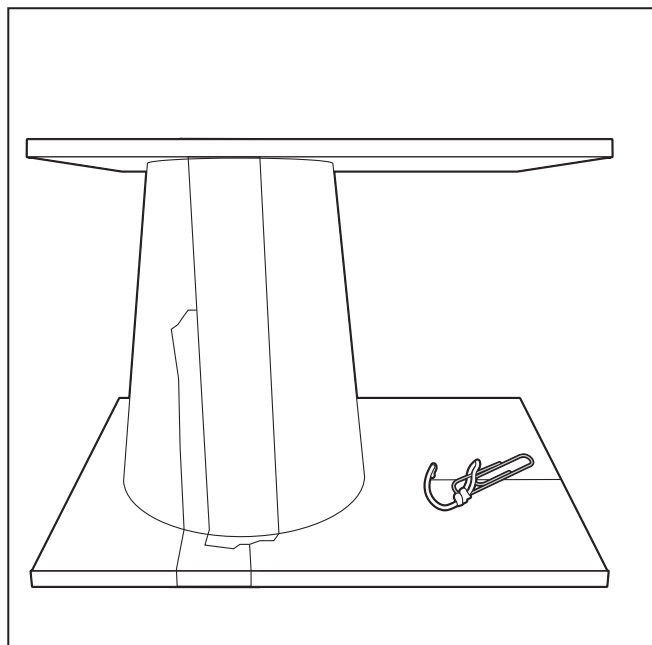
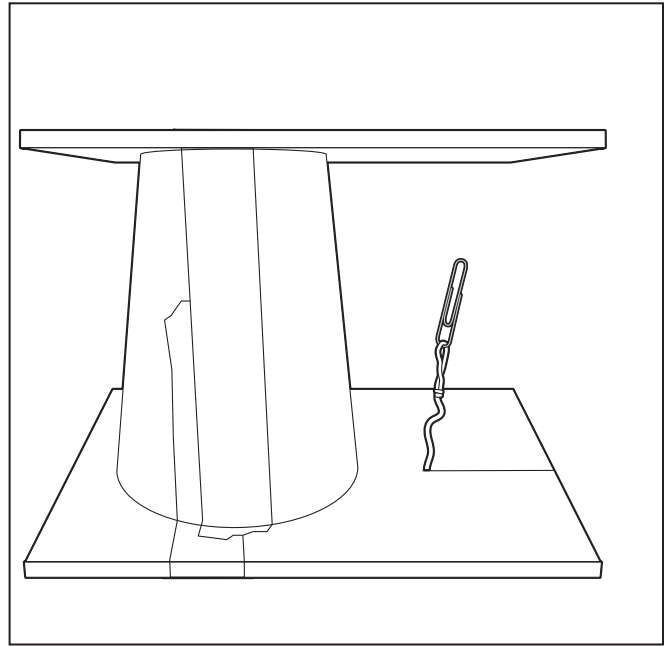
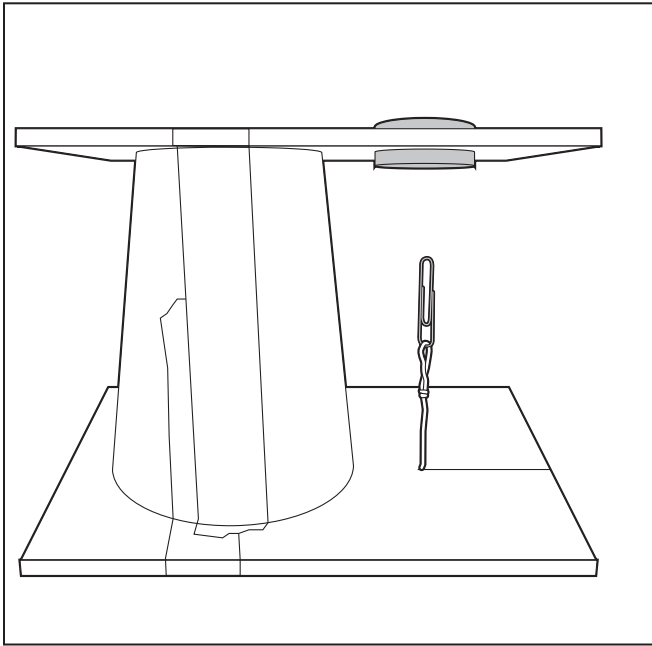
Make a drawing if it helps you explain your thinking. Label your drawing.



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.

Object	Force 1	Force 2	Balanced or unbalanced?	Does the object start moving?
paper clip	gravity (downward)	magnetic force (upward)	balanced	no
paper clip	gravity (downward)	none	unbalanced	yes (downward)
rope in tug-of- war game	touching force (pulling left stronger)	touching force (pulling right weaker)	unbalanced	yes (to the left)
kite on a string	wind (upward)	touching force of string (downward)	balanced	no
book held in hand	gravity (downward)	touching force (upward)	balanced	no
ball magnet	magnetic force (from a ring magnet)	none	unbalanced	yes (toward the ring magnet)

Name: _____ Date: _____

Planning an Investigation

Directions:

1. With your partner, plan what you will do to investigate how far the paper clip can be from the magnet before the forces become unbalanced in the Floating Paper Clip Device.
2. Answer the questions below.

How far do you think the paper clip can be from the magnet before the forces become unbalanced?

Draw a diagram that shows how you will do your investigation.



Describe what you will do for each test.

Name: _____ Date: _____

Planning an Investigation (continued)

What will you observe, measure and record? Add a label for what you will measure to your diagram.

What will you keep the same each time you run a test? Add labels to your diagram.

How many tests will you run? Why?

Name: _____ Date: _____

Results of the Investigation

Record your observations and measurements:

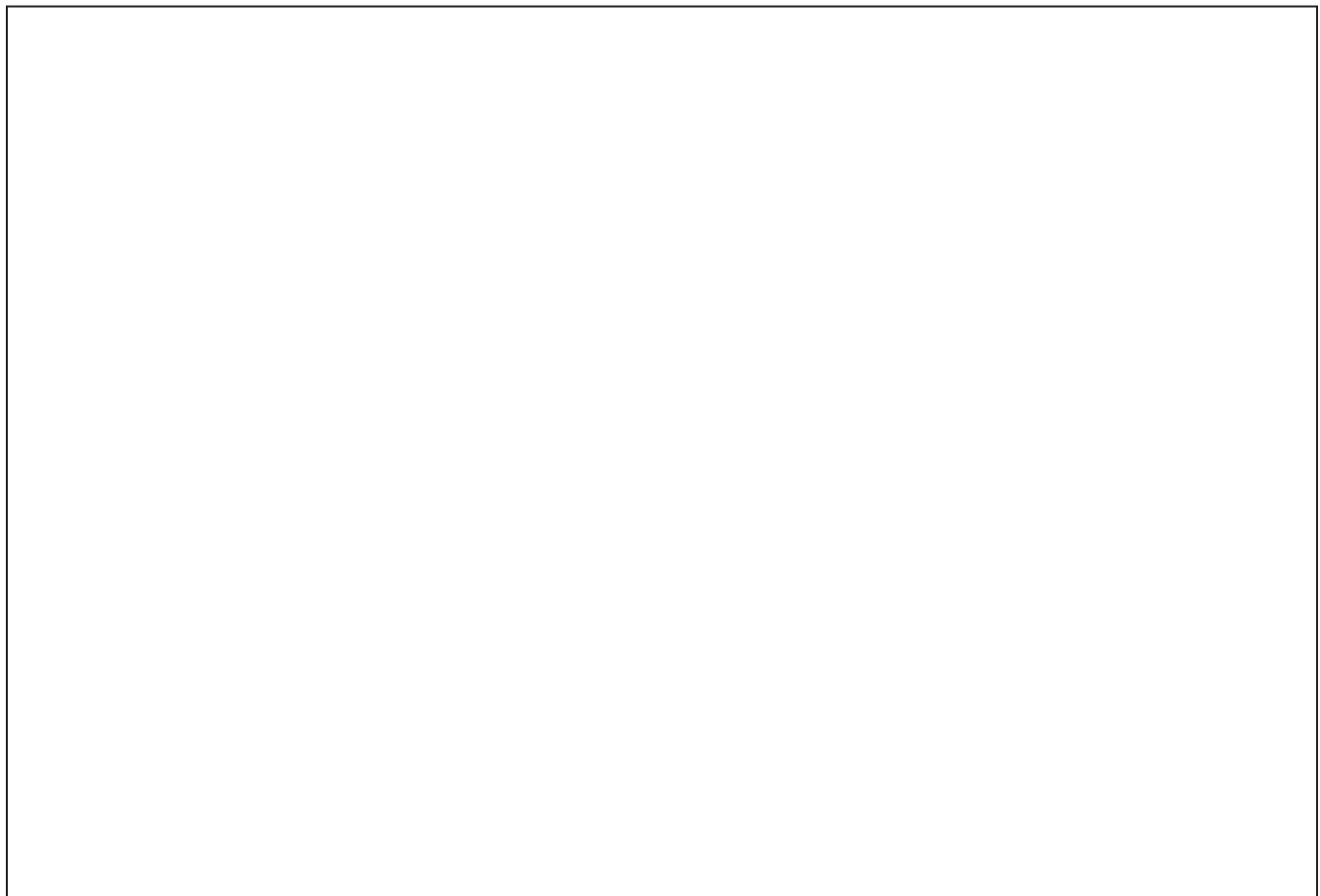
How far can the paper clip be from the magnet before the forces become unbalanced? Use the results of your investigation to support your answer.

Name: _____ Date: _____

Daily Written Reflection

What questions do you have about balanced and unbalanced forces?

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



Name: _____ Date: _____

Setting a Purpose for Reading **Hoverboard**

Directions:

1. Discuss with your partner and decide on a purpose for reading **Hoverboard**.
2. Check to make sure that your purpose will help you explain to the people of Faraday why the train floats even though gravity is acting on it.
3. Read **Hoverboard** and mark places in the book that have to do with your reading purpose.
4. Write notes about what you found in the book.

Reading purpose: To learn more about _____

Notes about what you read that has to do with your reading purpose:

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.

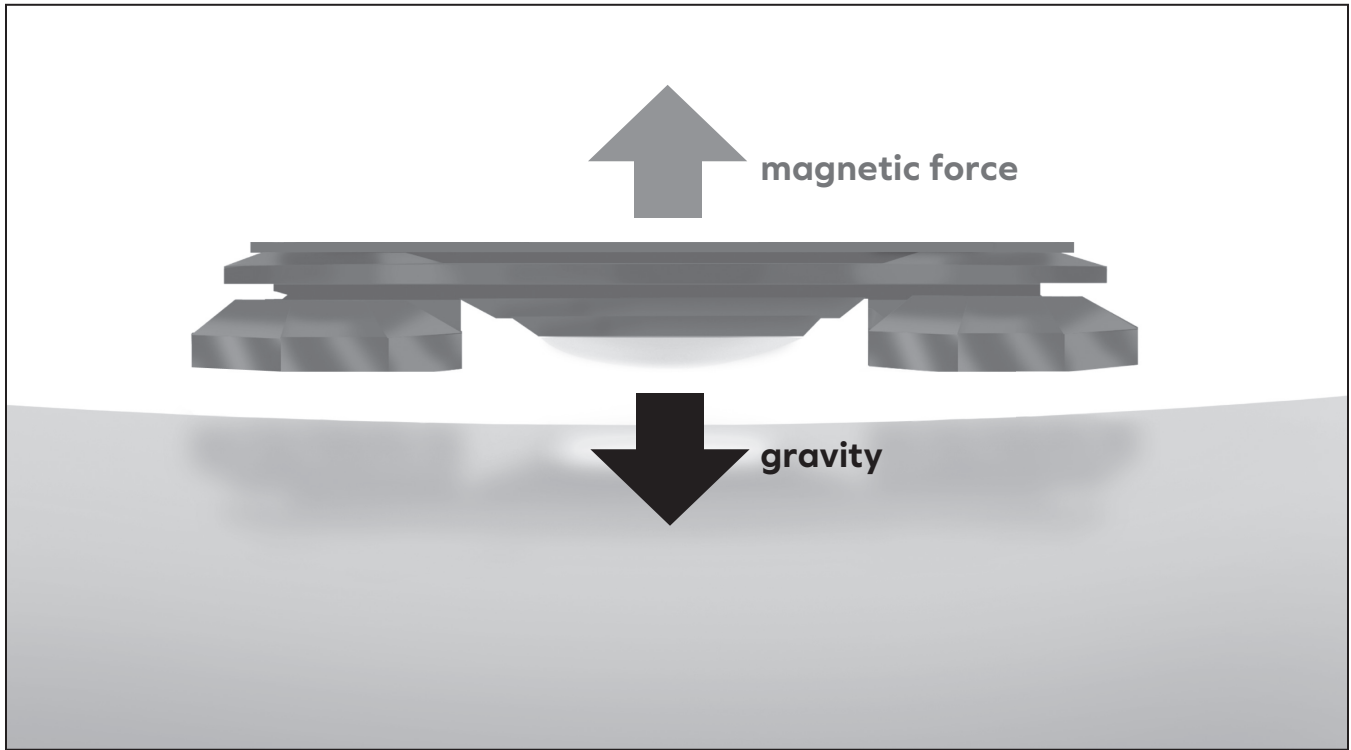
_____ There are magnets that can be turned on and off.

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

_____ Repelling magnets make the hoverboard float.

Reading Reflection: Hoverboard

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.

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

Name: _____ Date: _____

Chapter 5: 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.

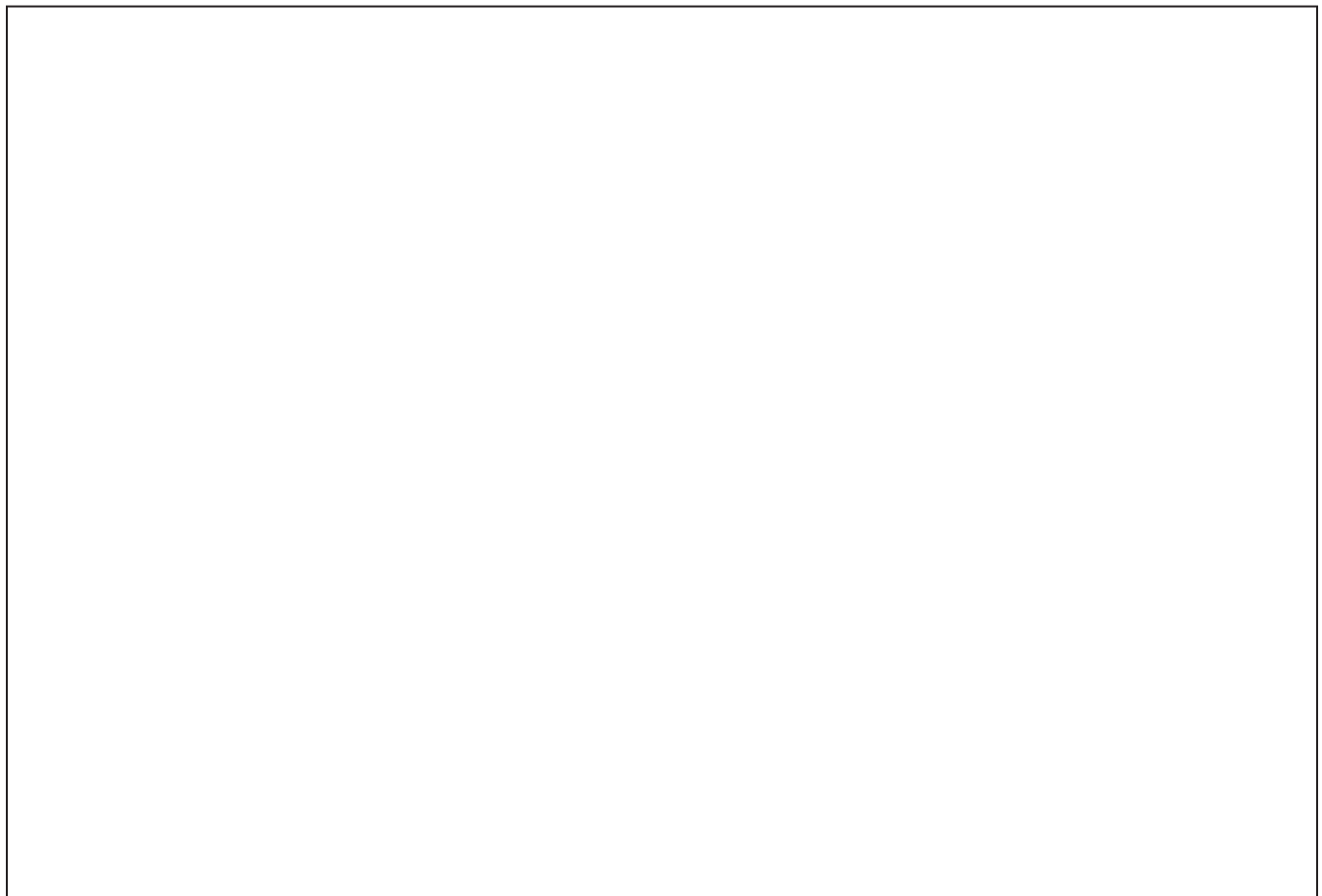


Name: _____ Date: _____

Daily Written Reflection

What questions do you have about how a hoverboard would work?

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



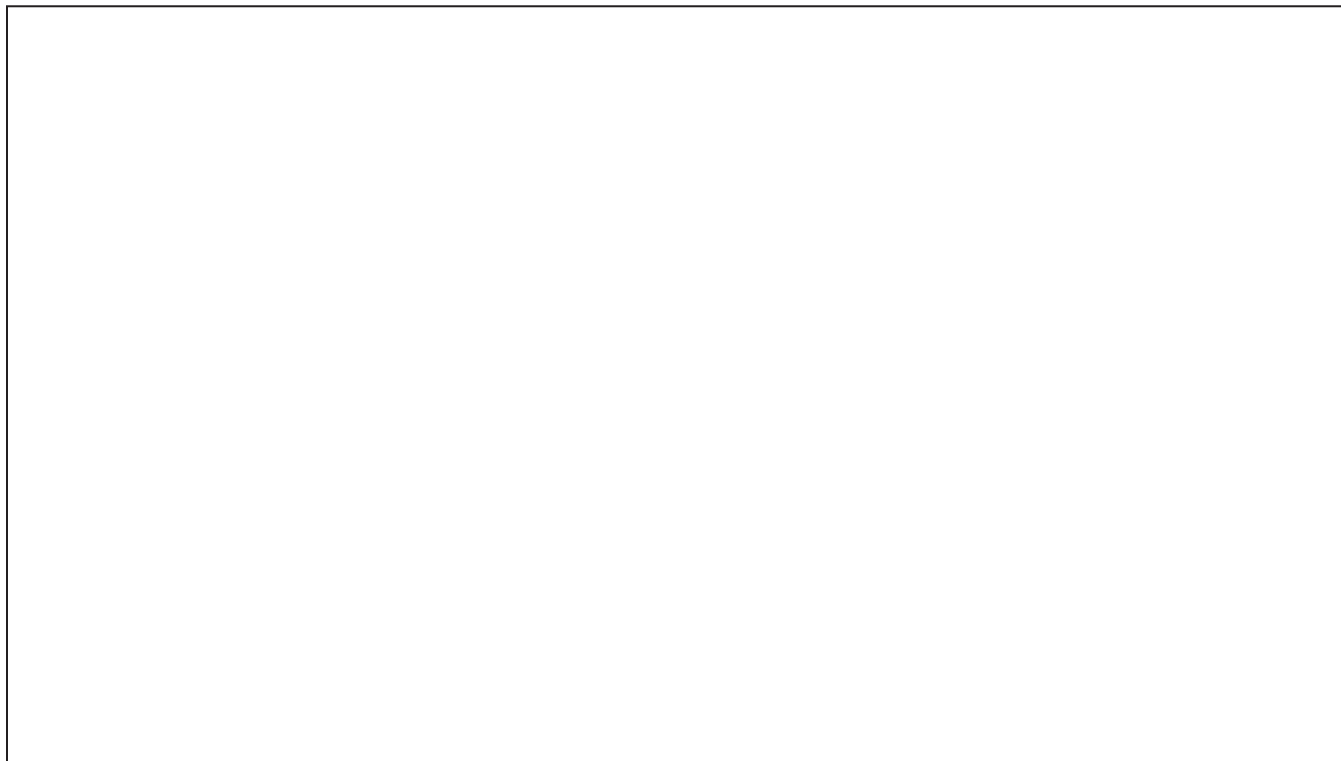
Name: _____ Date: _____

Patterns of Repeating Motion

Directions:

1. Discuss with your partner how one of these objects might move in a repeating pattern. Decide together and circle the object you choose:
 bouncy ball bicycle wheel
2. Draw and label a simple diagram showing how the object could move in a repeating pattern.
3. Write a caption explaining your diagram.

Diagram:



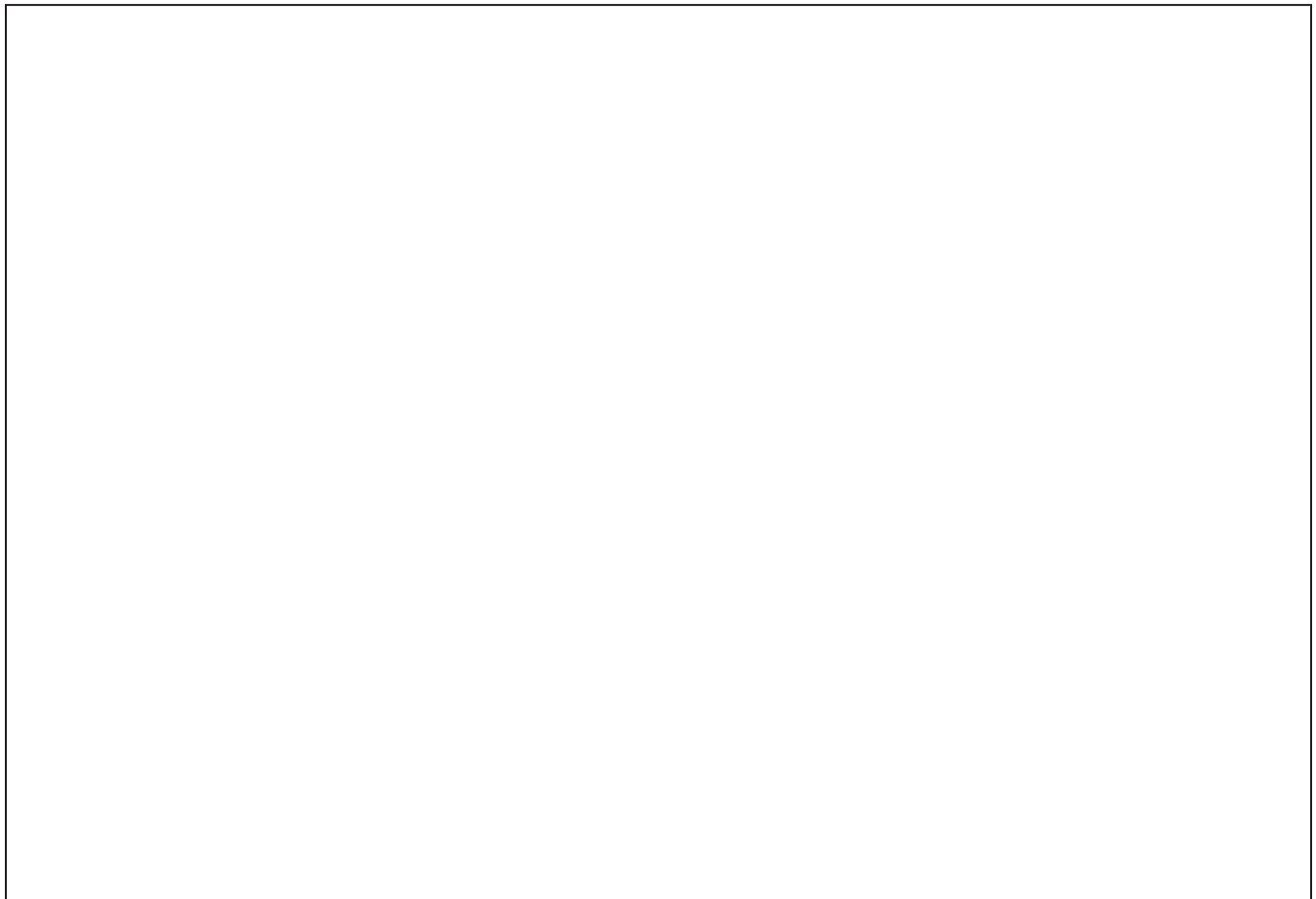
Caption:

Name: _____ Date: _____

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.



Name: _____ Date: _____

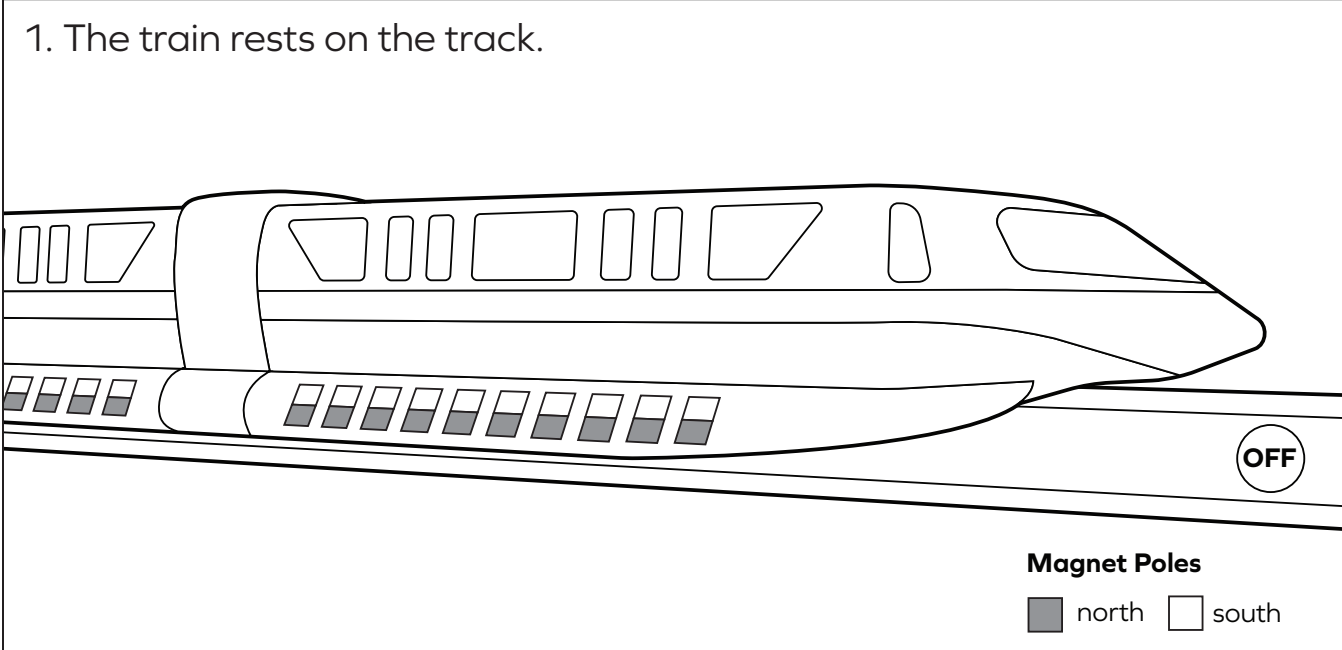
You can use this page to record notes or create drawings.

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.

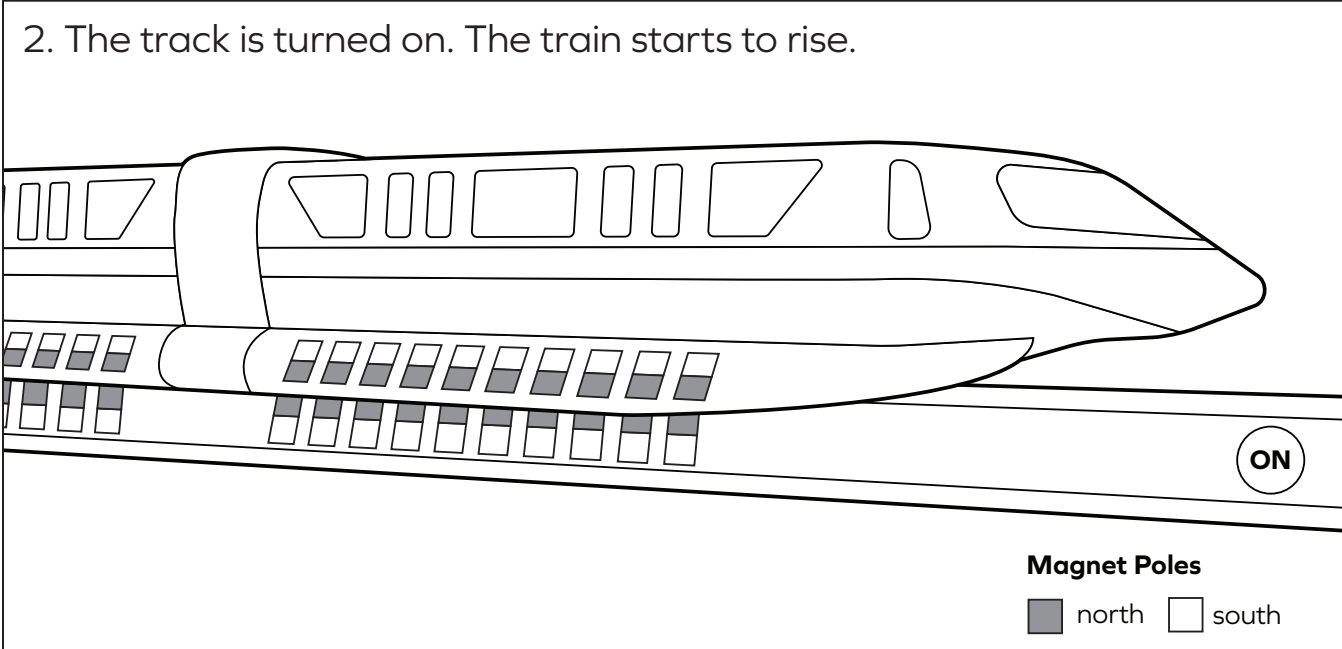
1. The train rests on the track.



The diagram shows a side view of a high-speed train on a track. The train has a long, aerodynamic nose and several windows. Below the train, there are two sets of rectangular magnets. The top set is on the train, and the bottom set is on the track. A circular switch labeled "OFF" is located on the right side of the track. A legend titled "Magnet Poles" indicates that a shaded square represents "north" and an unshaded square represents "south".

Magnet Poles
■ north □ south

2. The track is turned on. The train starts to rise.

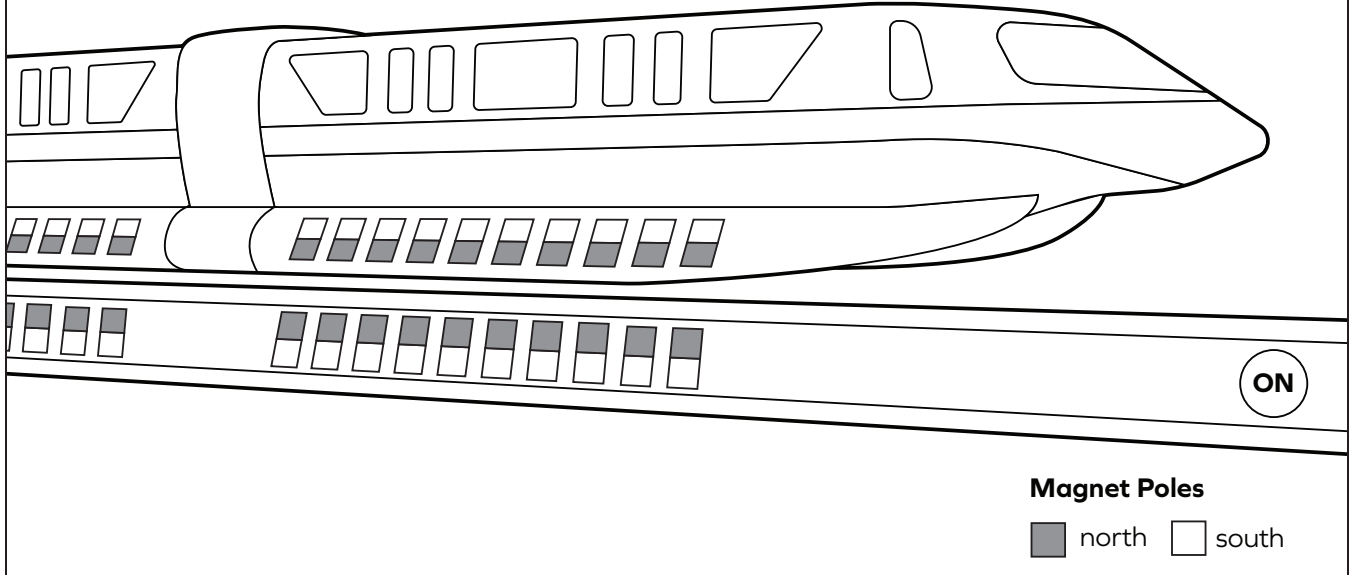


The diagram is identical to the one above, but the circular switch is now labeled "ON". The train is shown slightly elevated above the track, indicating it is levitating.

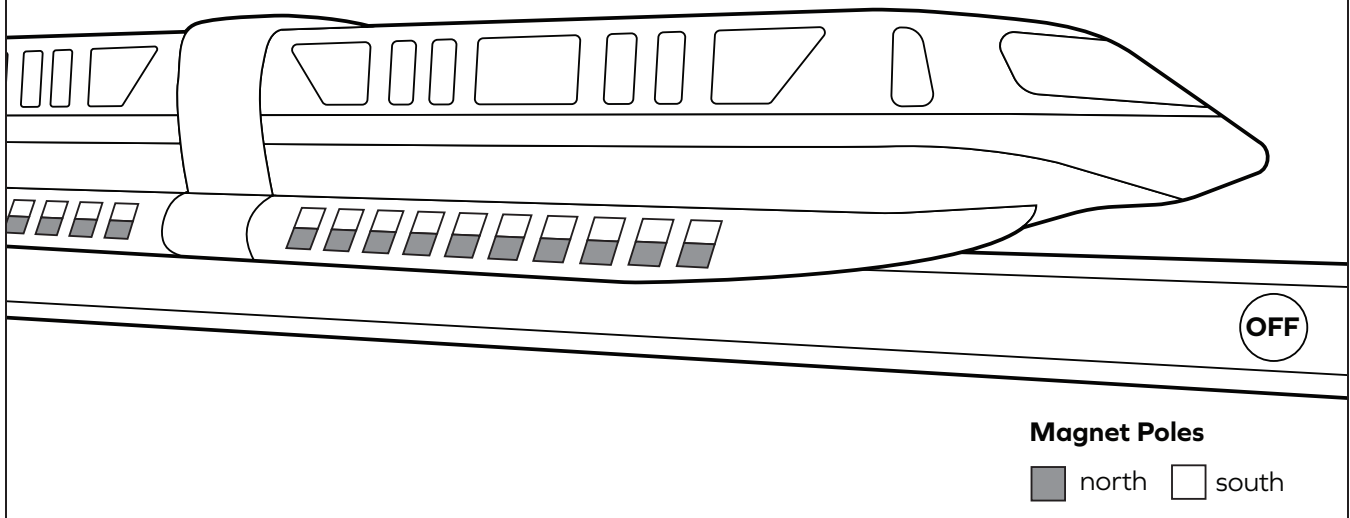
Magnet Poles
■ north □ south

Diagramming the Floating Train (continued)

3. The train is floating above the track.



4. The track is turned off. The train starts to fall.



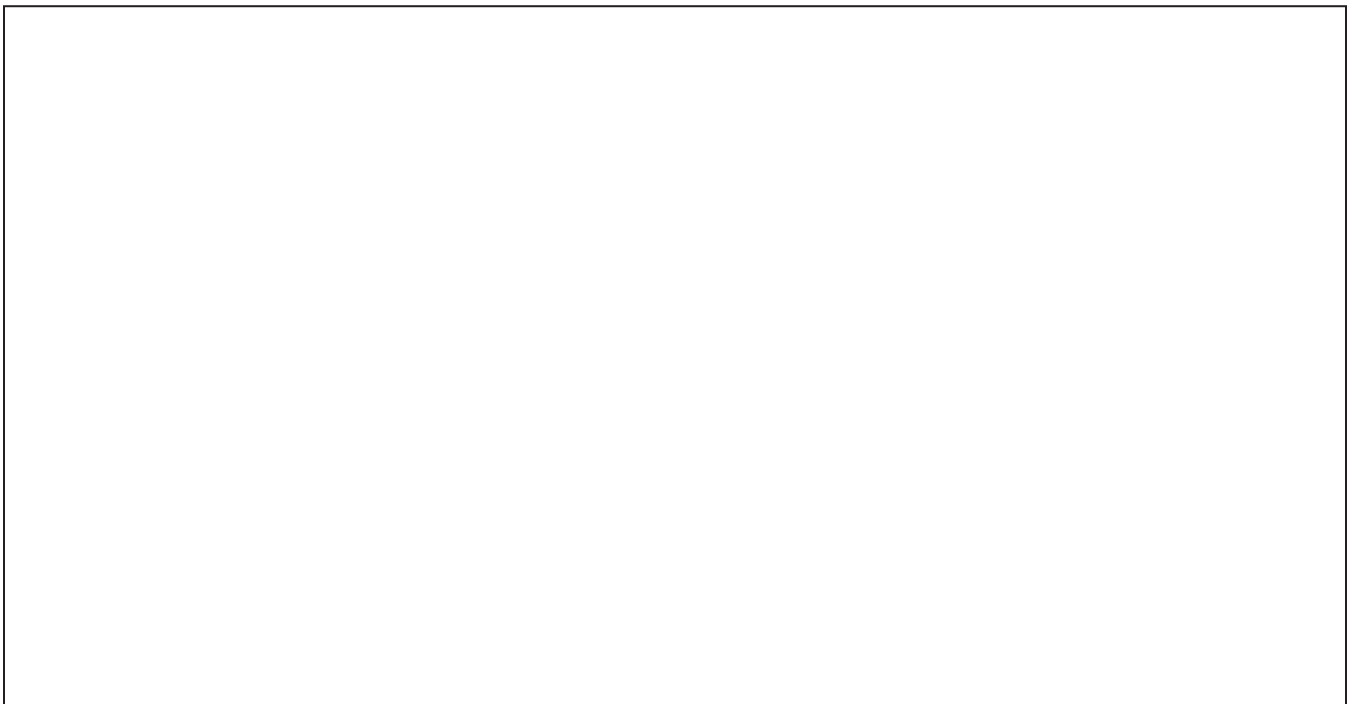
Name: _____ Date: _____

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.



Name: _____ Date: _____

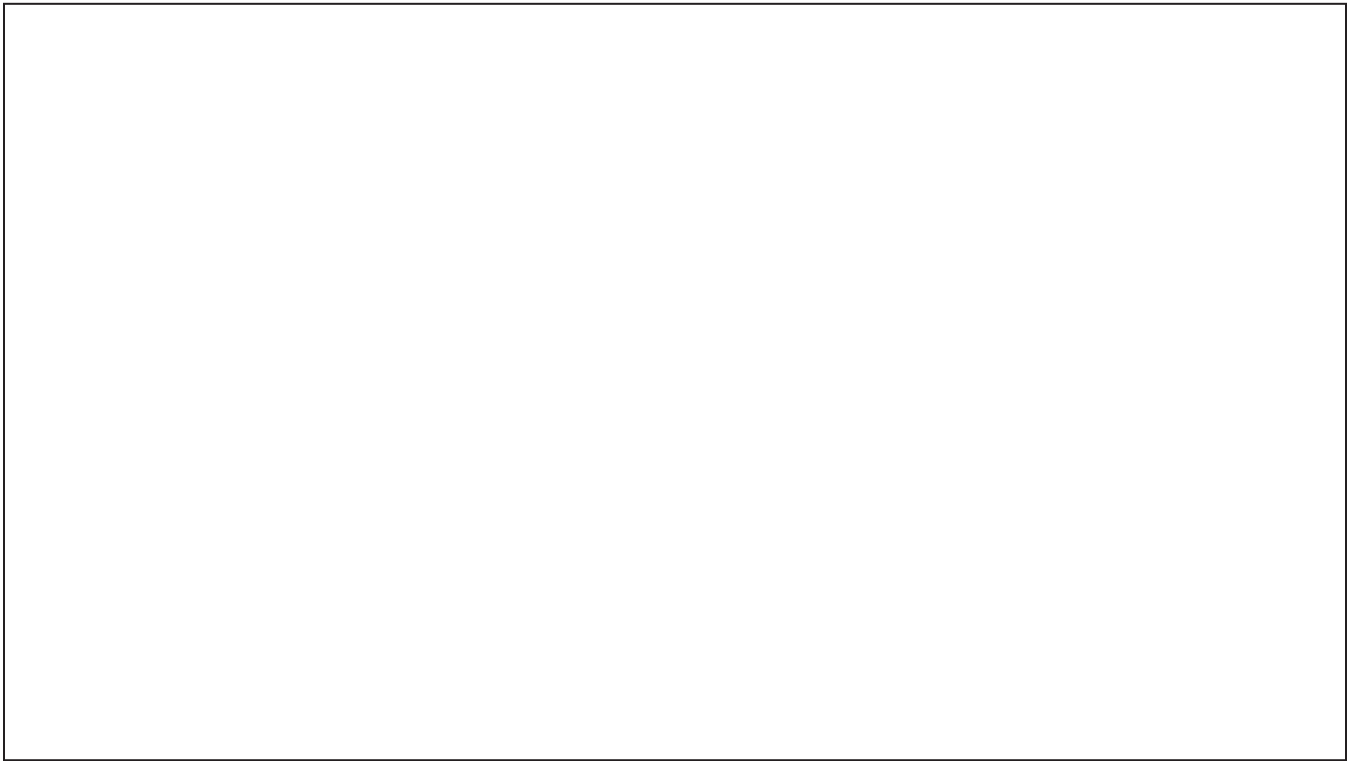
Inventing with Magnets

Directions:

1. Work with your partner to come up with an idea for an invention that uses magnetic force.
2. Make a diagram with labels to show your idea.
3. Write an answer to the question below.

Invention idea: _____

Diagram:



What problem will your invention help solve?

Name: _____ Date: _____

Chapter 5: 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

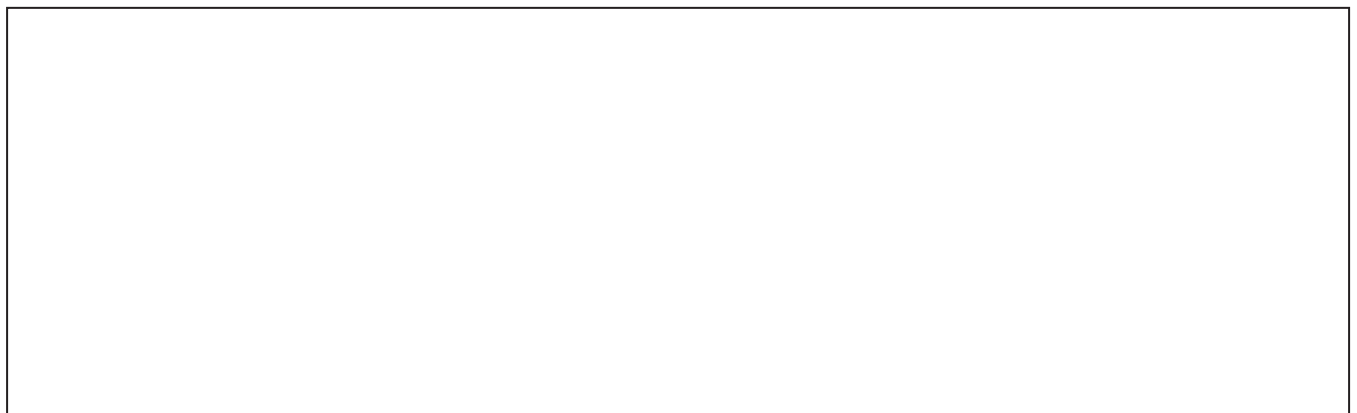
I understand why the train floats. _____ Yes _____ Not yet

I understand why the train changes from floating to falling. _____ Yes _____ Not yet

I understand that scientific explanations can change when there is new evidence. _____ 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.



Glossary

analyze: to make sense of data

analizar: pensar y entender los datos

attract: to pull on an object, even without touching it

atraer: jalar un objeto, aun sin tocarlo

balanced forces: multiple forces of equal strength acting on an object

fuerzas en balance: varias fuerzas de la misma intensidad actuando sobre un objeto

data: observations or measurements recorded in an investigation

datos: observaciones o mediciones apuntadas en una investigación

design: to try to make something new that solves a problem

diseñar: intentar crear algo nuevo que resuelva un problema

diagram: an illustration that shows how something works or what its parts are

diagrama: una ilustración que muestra cómo funciona algo o cuáles son sus partes

electromagnet: a kind of magnet that can be turned on and off

electroimán: 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/a: una persona que usa conocimientos científicos para diseñar algo que resuelva un problema

evidence: information that supports an answer to a question

evidencia: información que respalda una respuesta a una pregunta

Glossary (continued)

exert: to cause a force to act on an object

ejercer: hacer que una fuerza actúe sobre un objeto

explain: to describe how something works or why something happens

explicar: describir cómo algo funciona o por qué algo pasa

explanation: a description of how something works or why something happens

explicación: una descripción de cómo algo funciona o por qué 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 de aprender sobre 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 el jalón entre un imán y algunos tipos de metal

Glossary (continued)

model: something scientists make to answer questions about the real world

modelo: algo que los científicos crean para responder preguntas sobre el mundo real

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 recolectas con cualquiera de los cinco sentidos

observe: to use any of the five senses to gather information about something

observar: usar cualquiera de los cinco sentidos para recolectar información acerca de algo

pole: the part of a magnet that pushes or pulls

polo: 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 sobre un objeto

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Illustration: Cover: Tory Novikova; 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!



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