

Waves, Energy, and Information:

Investigating How Dolphins Communicate



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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.

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 is written for an audience.
4. It describes things that are not easy to observe.
5. It uses scientific language.

Name: _____ Date: _____

Ideas About Dolphin Communication

- 1. What do you notice about the dolphin calls?
- 2. Record your observations.

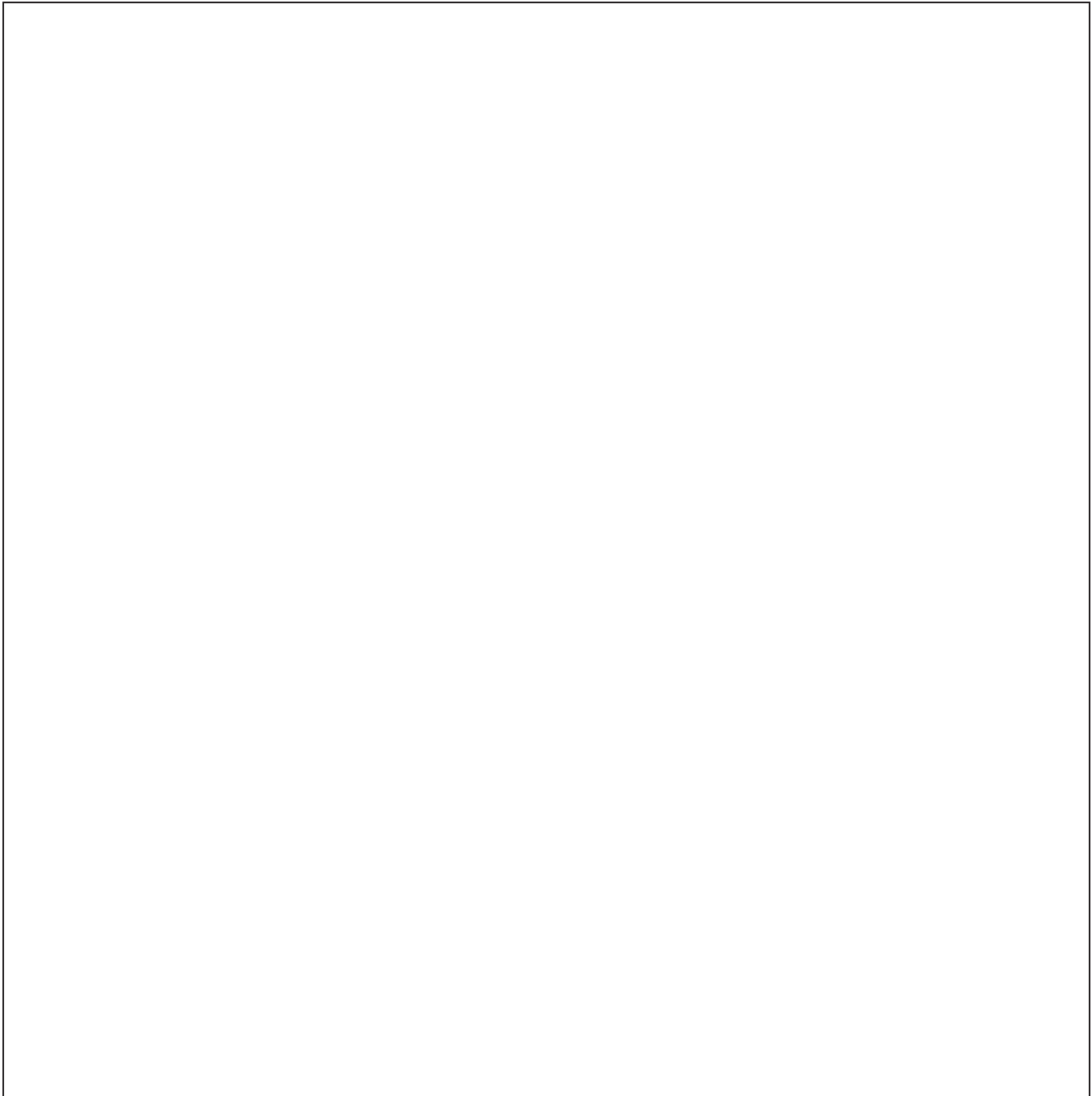
Name: _____ Date: _____

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

Name: _____ Date: _____

Think-Draw-Pair-Share: What Do You Know About Waves?

1. Think about the question *What do you know about waves?*
2. In the box below, make a drawing to explain your ideas.
3. Label your drawing.
4. Use your drawing to discuss your ideas with your partner.

A large, empty rectangular box with a thin black border, intended for students to draw and label their understanding of waves.

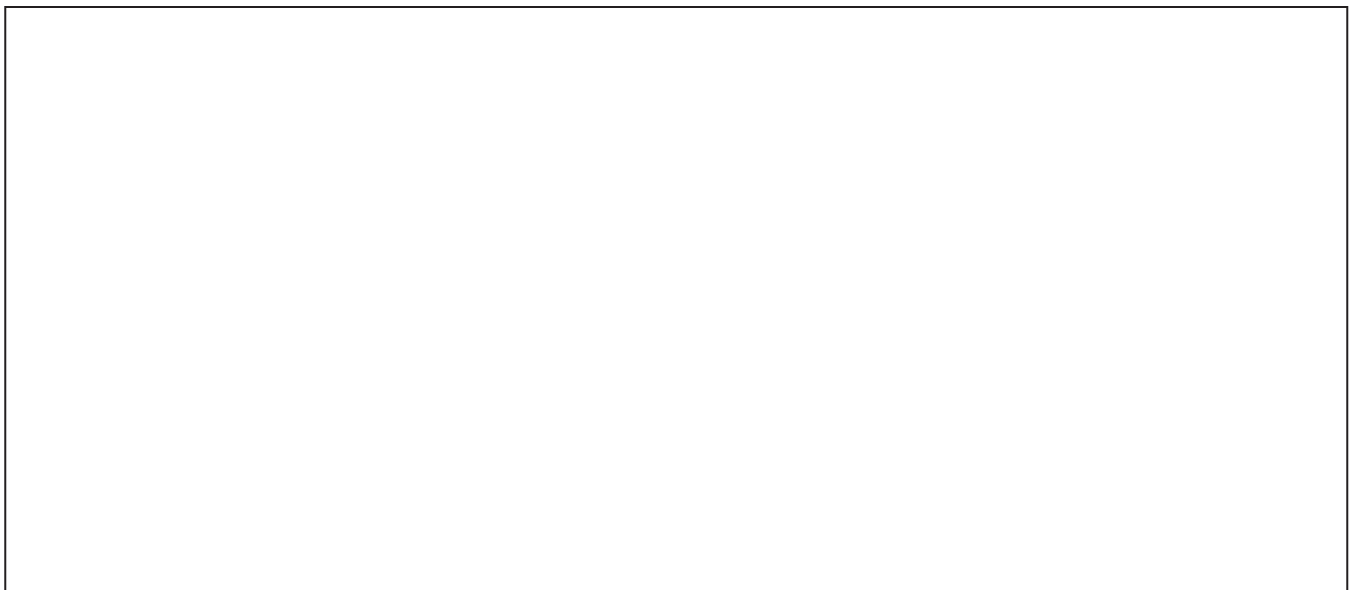
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Making Waves with a Rope

1. Two group members kneel on the floor on opposite ends of the rope and stretch the rope all the way out so it is straight.
2. One group member holds an end of the rope on the floor. The other group member repeatedly lifts the other end of the rope up and then flicks her wrist down to make even, steady wave patterns in the rope.
3. Group members who are not holding the rope should record their observations on the lines below.
4. Group members holding the rope switch roles with group members recording observations.

Describe the motion of the rope.

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



Name: _____ Date: _____

Making Waves with a Spring Toy

1. Two group members kneel on the floor on opposite ends of the spring toy and stretch the spring toy almost all the way out along the floor.
2. One group member holds an end of the spring toy steady, and the other group member pushes the other end of the spring toy forward (toward the other group member). Leave the spring toy on the floor and keep holding on to the ends.
3. Wait until the spring toy has stopped moving before pushing it again. Focus on pushing the spring toy forward rather than moving it side to side.
4. Group members who are not holding the spring toy should record their observations on the lines below.
5. Group members holding the spring toy switch roles with group members recording observations.

Describe the motion of the spring toy.

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

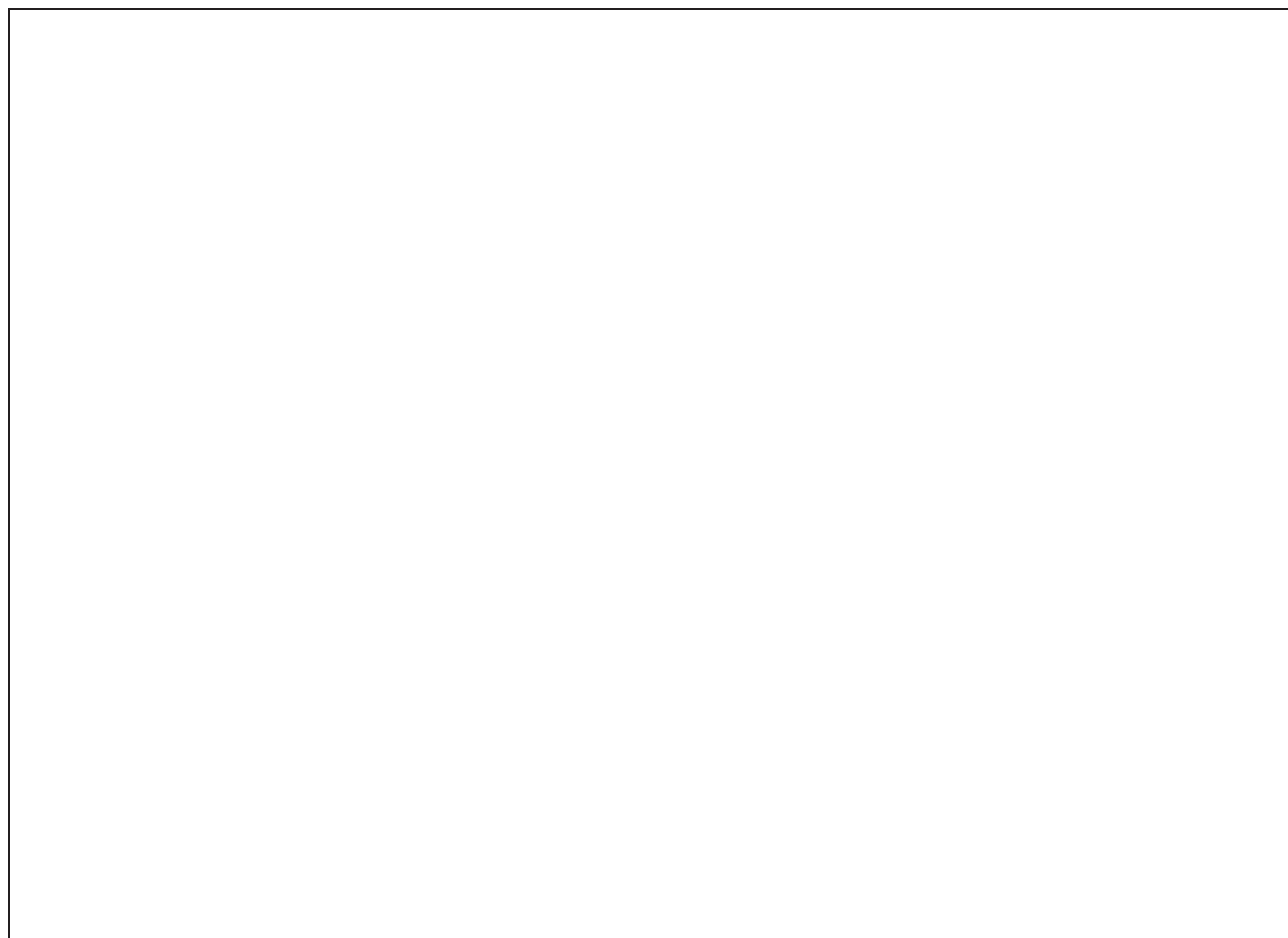


Name: _____ Date: _____

Daily Written Reflection

Think about examples of different waves that you have seen. How are they similar, and how are they different?

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



Getting Ready to Read: *Warning: Tsunami!*

1. Before reading the book *Warning: Tsunami!*, 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.

_____ Only some earthquakes cause tsunamis.

_____ Ocean waves are longer than tsunami waves.

_____ A tsunami can travel thousands of miles from its source in just a few hours.

_____ Tsunamis are only dangerous when they get close to land.

_____ There's no way to know when a tsunami is going to hit.

Visualizing While Reading *Warning: Tsunami!*

1. Visualizing means making a picture in your mind using information from different sources.
2. As you continue to read *Warning: Tsunami!*, visualize each of the measurements from the book, using what you know.
3. Draw or write what you visualize in the third column of the table below.

Page number	What the book says	What I think of when I visualize this measurement
8	Tsunamis are often just a few centimeters (a couple of inches) high as they travel across the ocean.	
9	A wavelength is the distance between two peaks of a wave. For a tsunami wave, this distance can be greater than 100 kilometers (about 60 miles)!	
10	Tsunami waves can travel as fast as 800 kilometers per hour (about 500 miles per hour) across huge distances.	
11	A tsunami wave reached here in 20 hours.	
13	An earthquake near Alaska can cause a tsunami that devastates Hawaii, about 4,600 kilometers (almost 3,000 miles) away.	

Multiple Meaning Words

Some words can mean more than one thing. For each word in the table:

1. Read the sentence from the book *Warning: Tsunami!* 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
wave	Sound waves , on the other hand, happen as invisible movements of particles that are too small for us to see.	a pattern of motion that travels away from a source	a gesture to say hello
hit	They may cause floods and terrible destruction when they hit land.	to come against with an impact or collision	to strike something with your hand
model	They use computer models to figure out where and when the tsunami is likely to hit land.	a person whose job is posing for artists or photographers	something scientists make to answer questions about the real world

Name: _____ Date: _____

Reading Reflection: *Warning: Tsunami!*

1. Turn to page 16 in *Warning: Tsunami!*
2. Look at the visual representation. Explain in your own words how a tsunameter works.

Make a drawing to explain your ideas. Label your drawing.

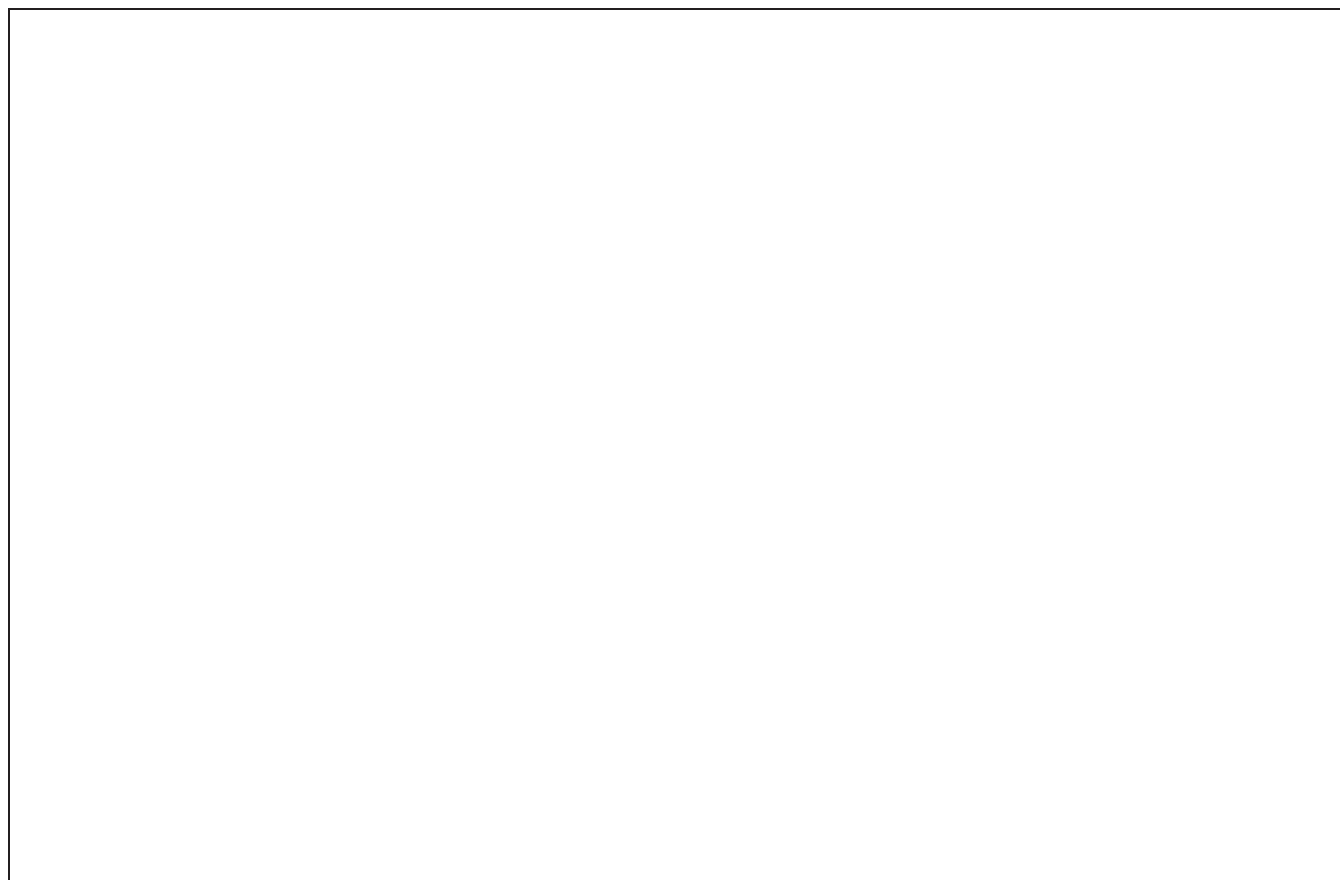


Name: _____ Date: _____

Daily Written Reflection

We have explored up-and-down patterns of motion and back-and-forth patterns of motion. What patterns of motion do you see in your everyday life?

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



Exploring the Sound Waves Simulation

1. In the second column of the table, record what you notice about the Simulation.
2. As you explore the Simulation, record what you wonder about in the third column.

Observations	What I notice	What I wonder
What I see moving		
The pattern I see		
The sounds I hear		
The source of the sound		

Name: _____ Date: _____

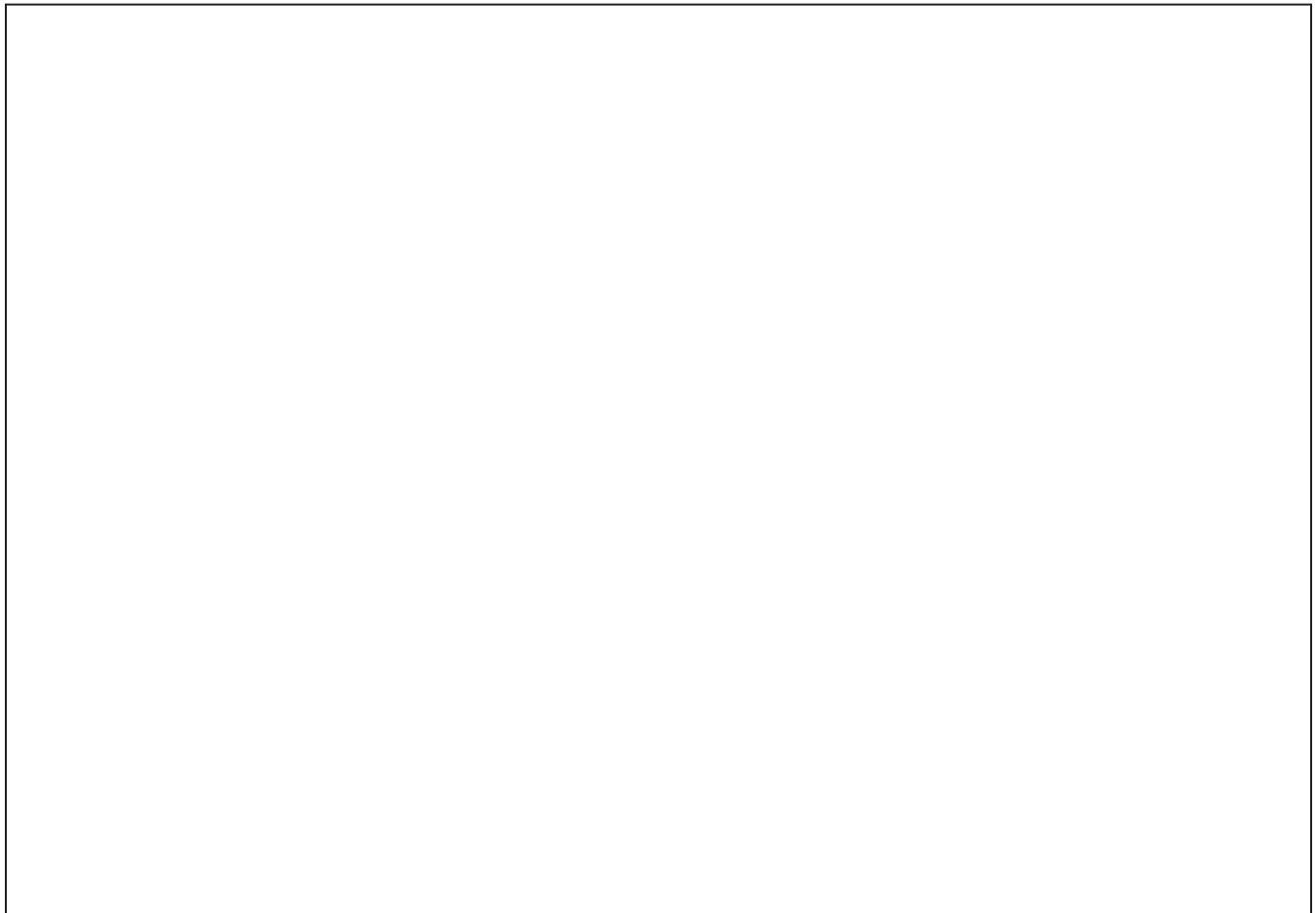
You can use this page to record notes or create drawings.

Name: _____ Date: _____

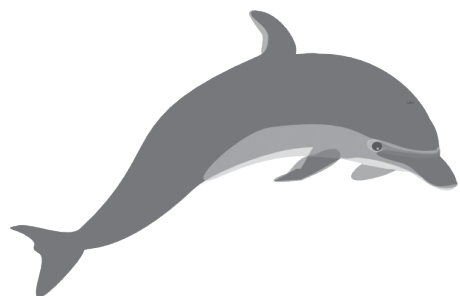
Daily Written Reflection

The ocean is full of sounds. What sounds do you think you could hear if you were able to spend a few days underwater?

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



Sound Diagram



mother dolphin



calf

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 explain how or why something happens. Am I getting closer to figuring out how a mother dolphin can communicate with her calf underwater?

I understand how sound gets from a mother dolphin to her calf. _____ Yes _____ Not yet

I understand what travels far in a sound wave and what moves only a little. _____ Yes _____ Not yet

I understand how sound energy travels through the particles of a material. _____ Yes _____ Not yet

I understand why some dolphin sounds are different from other dolphin sounds. _____ Yes _____ Not yet

I understand that science explanations describe how or why something happens. _____ Yes _____ Not yet

What are you still wondering about sound waves?

Name: _____ Date: _____

Daily Written Reflection

Write about a time that you heard sound traveling. What was the source of the sound? What was the sound traveling through?

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



What Does Sound Travel Through?

1. Follow your teacher’s directions for listening to sounds.
2. For each sound, write the source of the sound in the “Source” column.
3. In the “Listener” column, write who the listener is.
4. Then, visualize the sound energy traveling from the source to the listener.
In the third column, write what the sound travels through.

Source	Listener	What does the sound travel through?

Getting Ready to Read: *Sound on the Move*—Part 1

1. Before reading pages 4–13 of *Sound on the Move*, 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 pages 4–13, see if your ideas have changed. Be ready to explain your thinking.

_____ Many animals make sounds to communicate with each other.

_____ The ground, water, and air are made of millions and millions of particles.

_____ When people talk, their vocal cords vibrate.

_____ Birds have the same body parts that humans have for making sounds.

_____ Sound can travel through air, water, and solids to reach another animal.

Multiple Meaning Words

Some words can mean more than one thing. For each word in the table:

1. Read the sentence from the book *Sound on the Move* 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
material	The air, the water, and the ground are all materials .	fabric	the stuff that makes up everything
structure	Like other animals, we have structures that help us make sounds.	the way something is shaped or what it is made of that makes it good for a specific function	something you climb on in a playground
song	At dawn, mountain bluebirds sing a loud chirping song .	a special voice signal made by an animal	something people sing or play on an instrument

Name: _____ Date: _____

Reading Reflection:
Sound on the Move—Part 1

Reread pages 10–13 about how mountain bluebirds use sound to communicate.

In your own words, describe how a sound gets from a mountain bluebird to a listener.

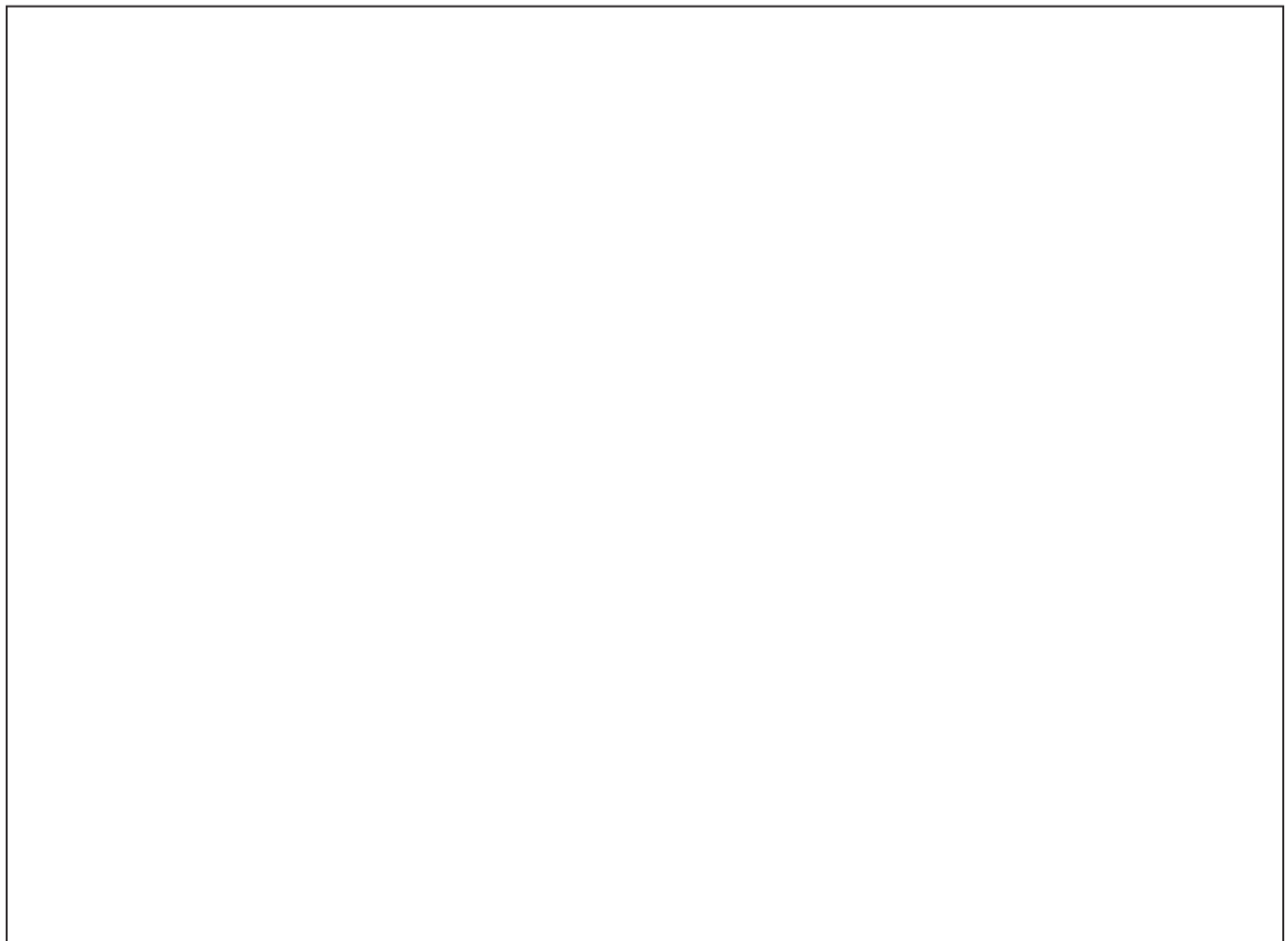
What questions do you have about how sound travels through air?

Name: _____ Date: _____

Daily Written Reflection

What is one thing you learned from reading the book *Sound on the Move*?

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



Name: _____ Date: _____

Observing Sound Traveling in the Sim

1. Select an instrument in the Sound Waves Simulation.
2. Press Play and observe what happens using your eyes and ears.
3. Record observations of what you see and hear.
4. Repeat Steps 1–3 with a different instrument.

Instrument: _____

Observations

Instrument: _____

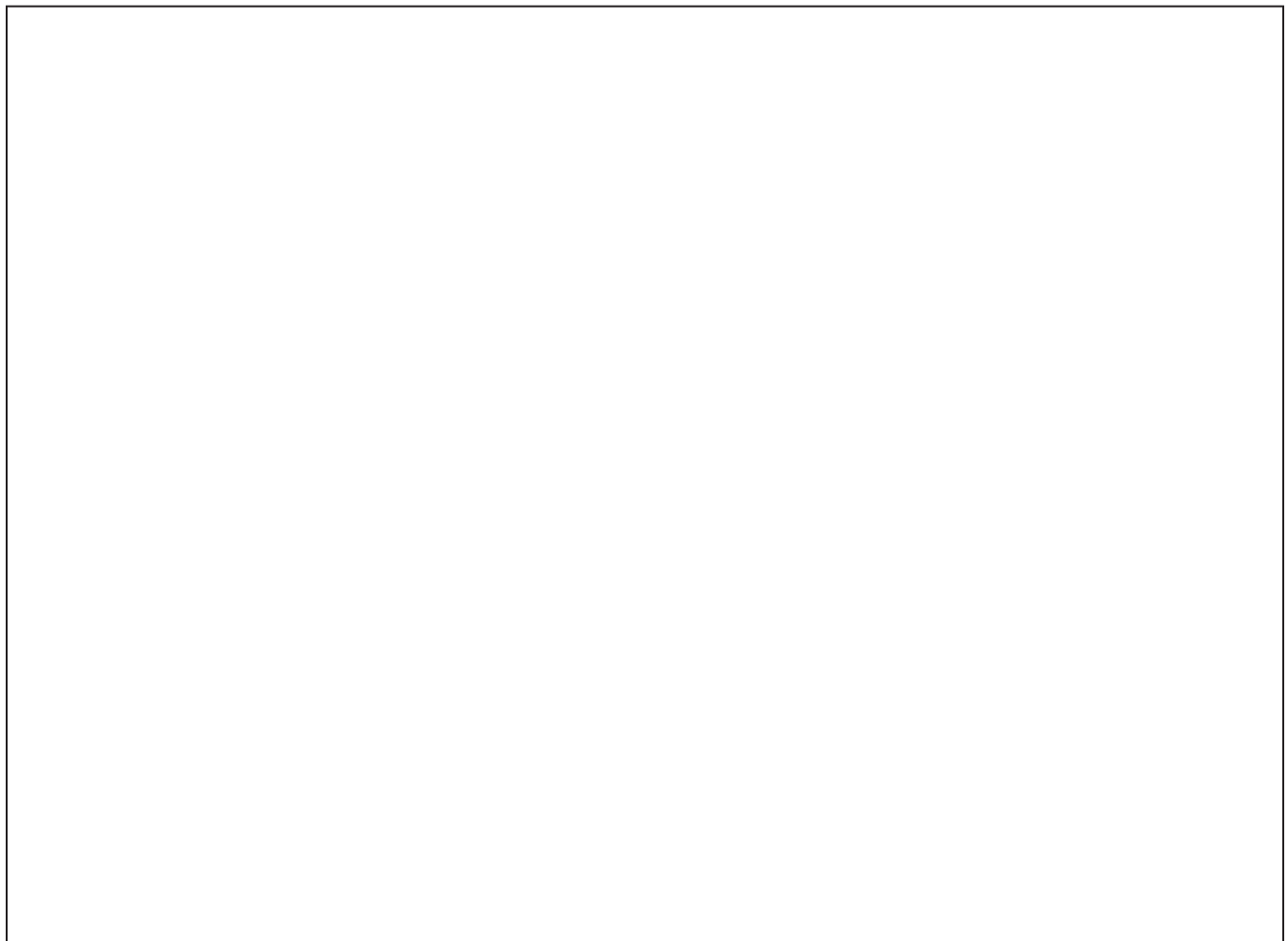
Observations

Name: _____ Date: _____

Daily Written Reflection

Describe a time when you have heard animals use sound to communicate.

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

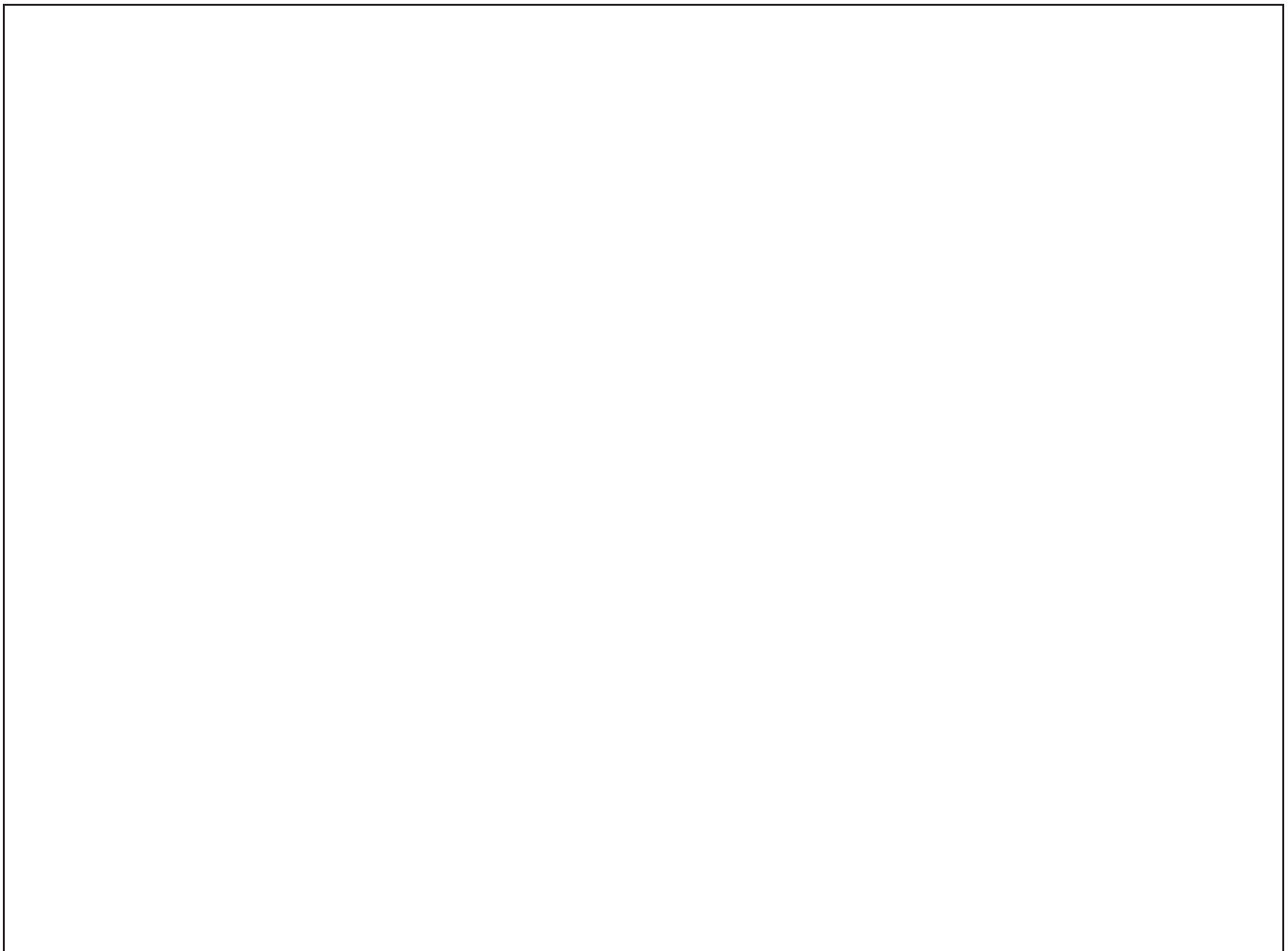


Observing Sound Energy Traveling

How does sound energy travel through a material?

1. Open the Sound Waves Sim.
2. Select an instrument and press Play.
3. Select a particle. Observe the motion of the particle as the sound energy travels across the screen.
4. Repeat Steps 2–3 with a different instrument.

Choose one of the instruments you selected in the Sim and draw what you observed as the sound energy from the instrument traveled away from the source. Label your drawing.



Getting Ready to Read: *Sound on the Move—Part 2*

1. Before reading pages 14–22 of *Sound on the Move*, 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 pages 14–22, see if your ideas have changed. Be ready to explain your thinking.

_____ Sound can travel through air, water, and solids.

_____ Humans are the only animals that can communicate with each other by using sound.

_____ Sounds can travel long distances in the ocean.

_____ The particles that make up the ground do not move at all.

Reading Reflection: *Sound on the Move*—Part 2

The source of each sound described in *Sound on the Move* is in the “Source” column of the table below.

1. In the “Listener” column, write who the listener is.
2. Then, visualize the sound energy traveling from the source to the listener. In the third column, write what the sound travels through.

Source	Listener	What does the sound travel through?
Human (pages 6–7)		
Mountain bluebird (pages 10–13)		
Sperm whale (pages 14–17)		
Kangaroo rat (pages 18–21)		

3. Choose one of the animals from the book. Draw a diagram of how the sound the animal makes gets from the source to the listener. Include particles in your drawing. Label your drawing.

Word Map: Particle

My definition	Diagram
particle	
Sentence	Example

Word Map: Collision

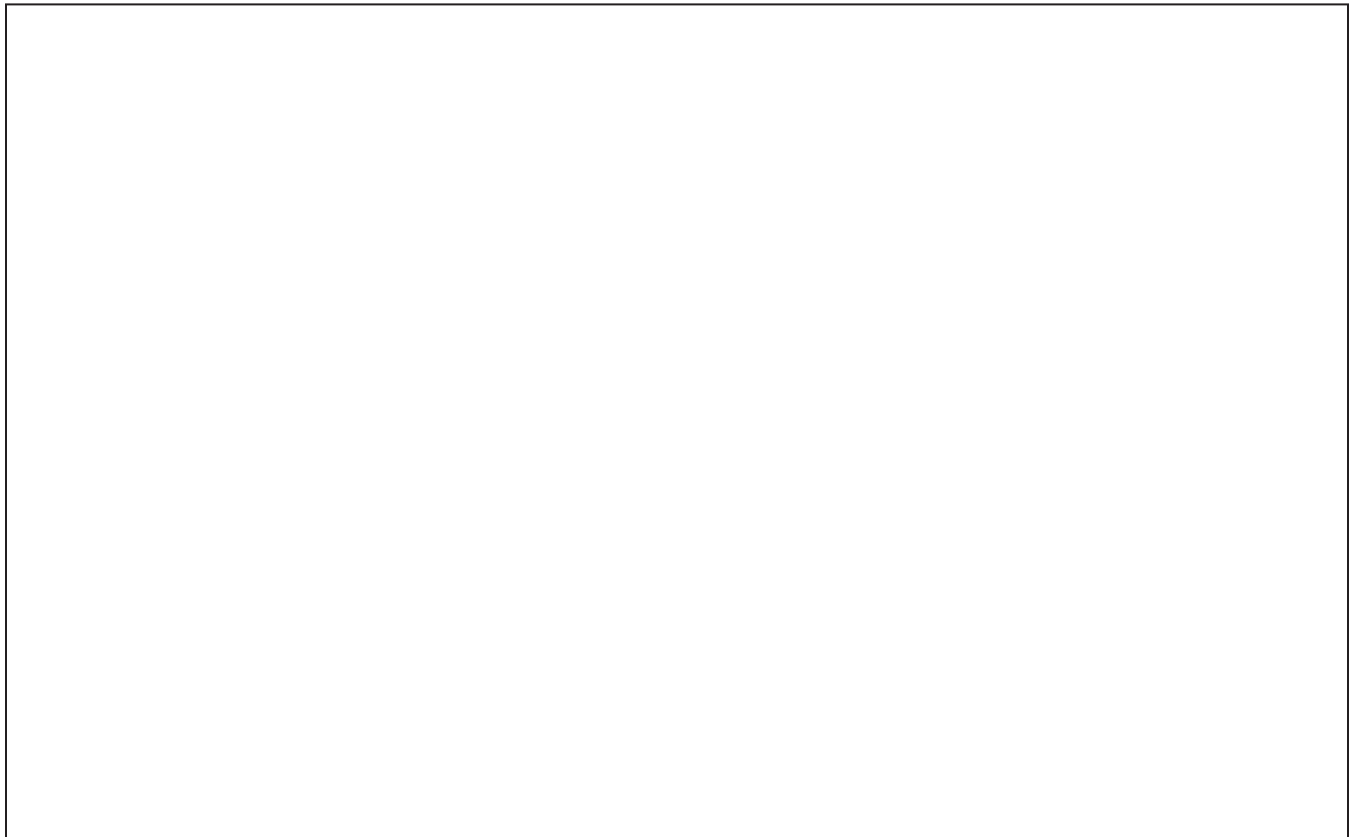
My definition	Diagram
collision	
Sentence	Example

Name: _____ Date: _____

Daily Written Reflection

You have learned that a sound wave is a pattern of motion that occurs when particles of a material collide and spread apart. Think about another example of when objects collide, or bump into each other. What happens to those objects?

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



Name: _____ Date: _____

Think-Draw-Pair-Share: Modeling Particle Collisions

1. Think about the question *How is the spring toy a model of particle collisions?*
2. In the box below, make a drawing to explain your ideas.
3. Label your drawing. You can also include symbols to show how the particles move.
4. Use your drawing to discuss your ideas with your partner.

A large empty rectangular box with a thin black border, intended for students to draw and label their model of particle collisions.

Investigating Energy Transfer with Coins

1. Work with a partner. Make sure that both you and your partner have a chance to try both of the investigations.
2. You have 5 minutes to complete each investigation.
3. During the investigations, you cannot touch the pennies with your hands, but you can touch the nickel.

Investigation 1

Place the nickel and one penny on the desk in front of you.

Goal: Without touching the penny with your hands, make both coins move.

How did you do it? What did you observe? Draw a picture if it helps you explain.



Name: _____ Date: _____

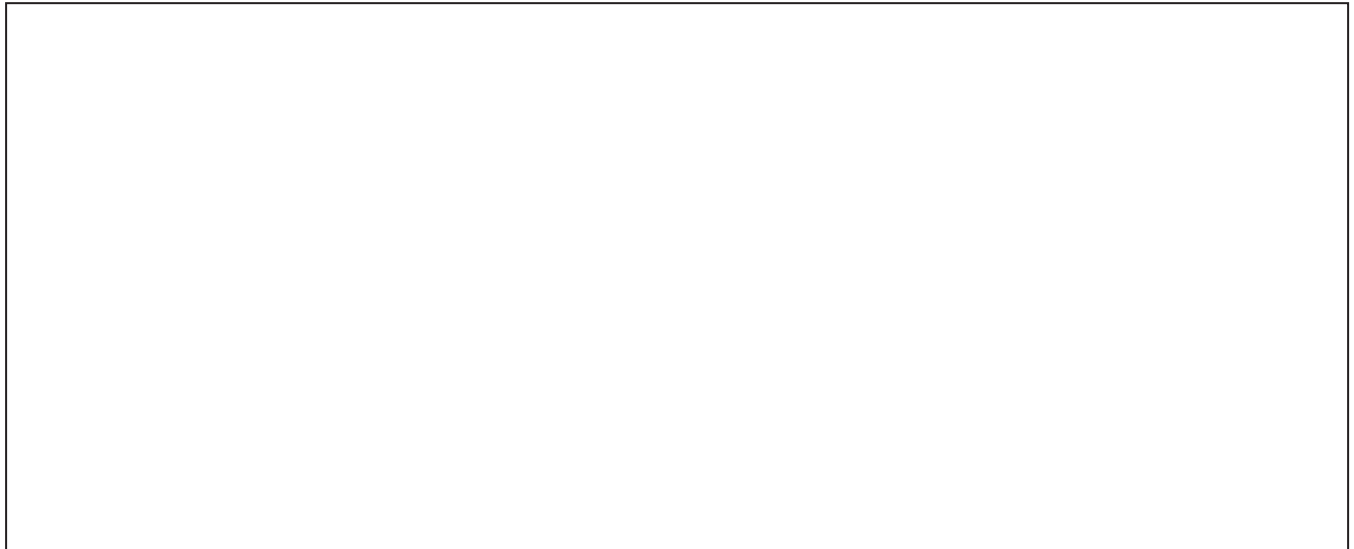
Investigating Energy Transfer with Coins (continued)

Investigation 2

Place all the coins on the desk in front of you.

Goal: Without touching the pennies with your hands, make all four coins move.

How did you do it? What did you observe? Draw a picture if it helps you explain.



Name: _____ Date: _____

Reflecting on the Coin Collision Investigations

Answer the questions below based on what you observed when you investigated energy transfer with coins.

1. How are the coins a model of particle collisions?

2. When coins collide, what happens to each coin?

Name: _____ Date: _____

Daily Written Reflection

What happens when two balls (for example, basketballs, tennis balls, or soccer balls) collide? Explain what happens to each ball when it collides with the other ball.

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



Name: _____ Date: _____

Particle Collision Model

How does your model show sound energy traveling as a series of particle collisions?

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



Word Map: Transfer

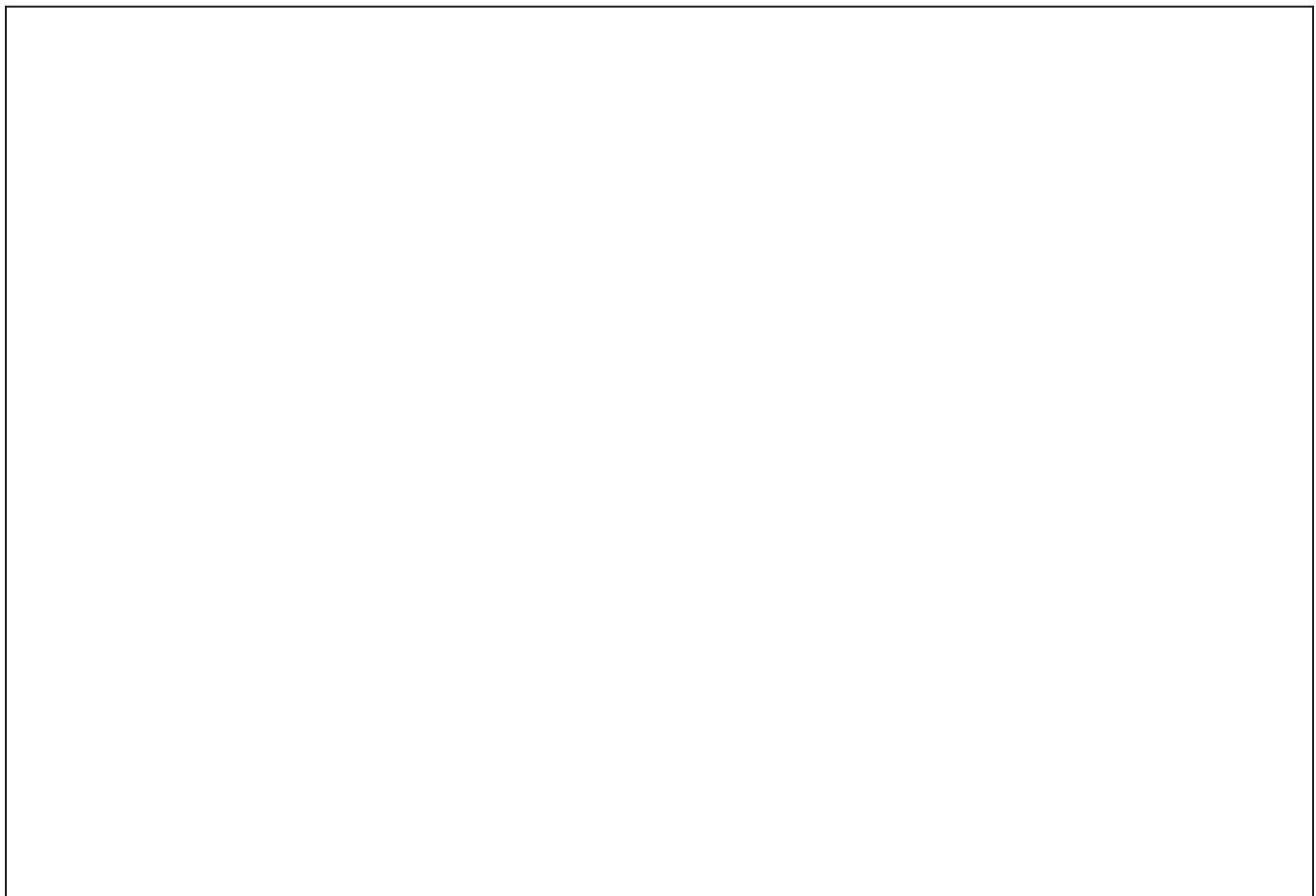
My definition	Diagram
transfer	
Sentence	Example

Name: _____ Date: _____

Daily Written Reflection

Why are models such as the Sound Waves Simulation and our Sound Diagrams important to use as we study sound?

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



Name: _____ Date: _____

Scientific Language for Explanations

The dolphin calf can hear the mother because _____.

When sound energy travels through the water _____.

This means _____.

This happens because _____.

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 explain how or why something happens. Am I getting closer to figuring out how a mother dolphin can communicate with her calf underwater?

I understand how sound gets from a mother dolphin to her calf. _____ Yes _____ Not yet

I understand what travels far in a sound wave and what moves only a little. _____ Yes _____ Not yet

I understand how sound energy travels through the particles of a material. _____ Yes _____ Not yet

I understand why some dolphin sounds are different from other dolphin sounds. _____ Yes _____ Not yet

I understand that science explanations describe how or why something happens. _____ Yes _____ Not yet

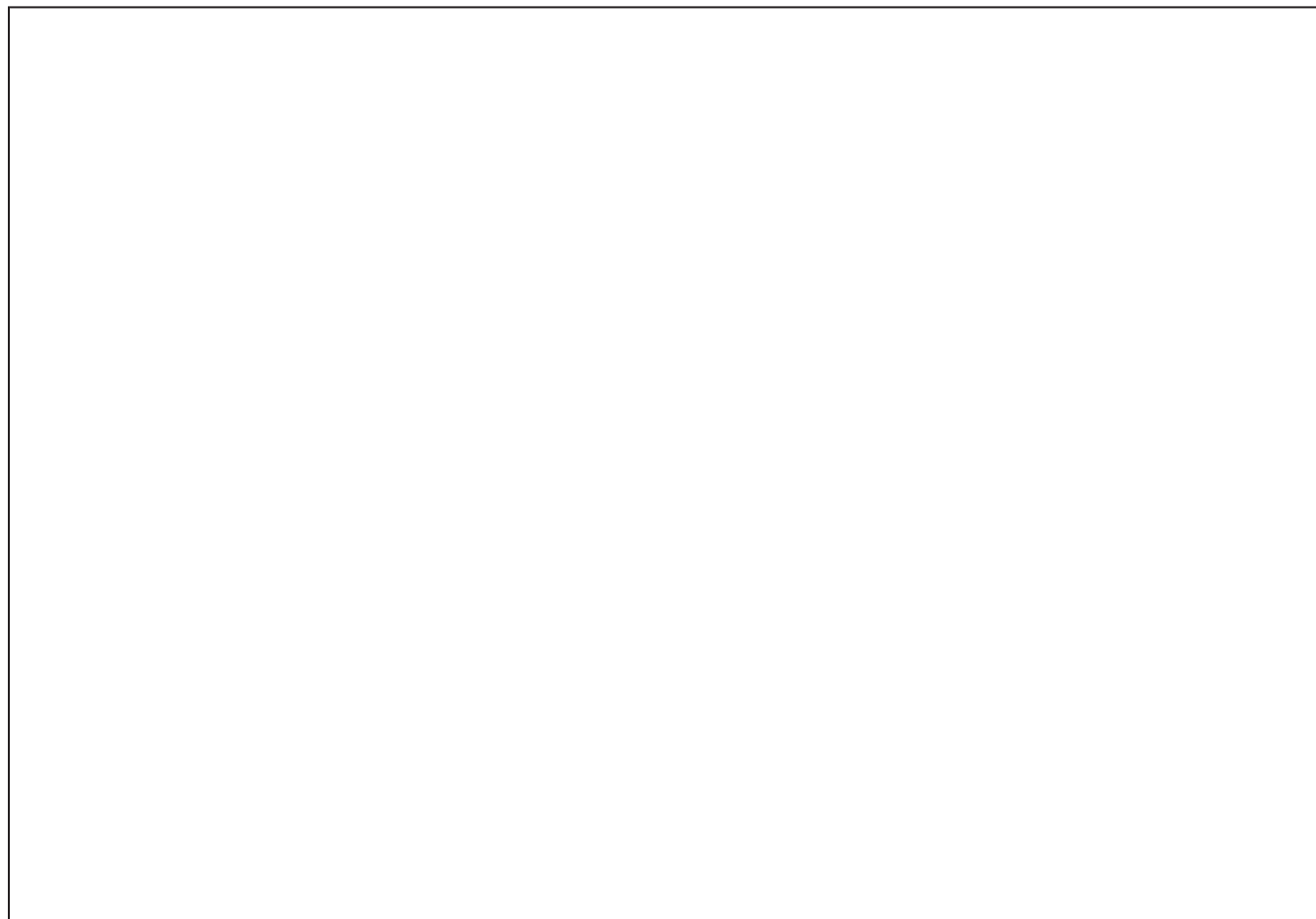
What are you still wondering about sound waves?

Name: _____ Date: _____

Daily Written Reflection

Think of two sounds that are very different. Describe each of the sounds. How are they different?

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



Name: _____ Date: _____

Investigating Amplitude

1. Open the Custom Sound mode of the Sound Waves Sim.
2. Press Play to play a sound, and while the sound is playing, use the Amplitude slider to change the sound.
3. Observe what happens as you change the sound. Use your eyes and ears to make your observations.
4. Use what you observed to answer the questions below.

The amplitude is _____ (larger/smaller) when the sound is louder.

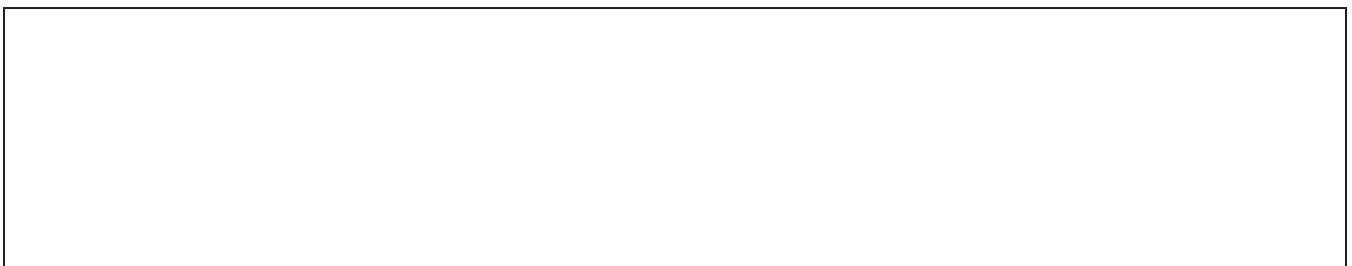
The amplitude is _____ (larger/smaller) when the sound is quieter.

What happens to the waveform when you change the amplitude?

Draw a waveform for a loud sound.



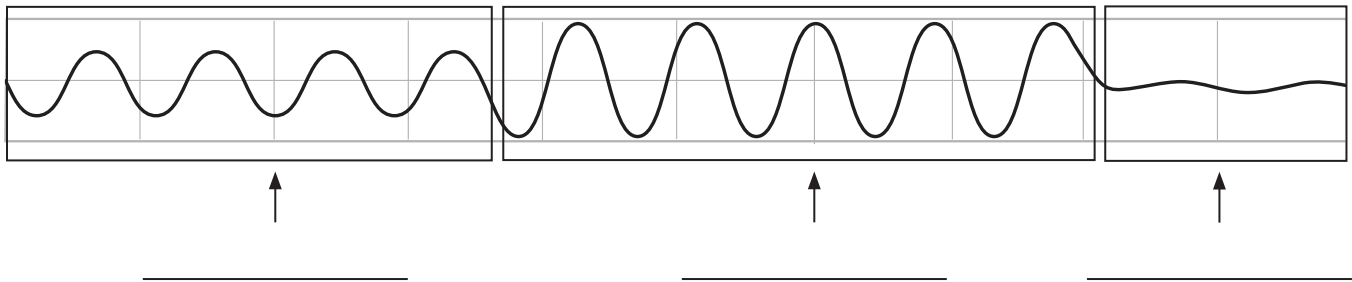
Draw a waveform for a quiet sound.



Analyzing Amplitude

1. Look at the Wave Printout below. Label the volume of the sound in each section of the waveform. You can use the following words as labels: **loud, medium, quiet.**
2. Open the Custom Sound mode of the Sound Waves Sim.
3. Press Play to play a sound, and as the sound is playing, use the Amplitude slider to try to make the Wave Printout match the one shown below. It may take a few tries!
4. Update your labels if needed.

Wave Printout

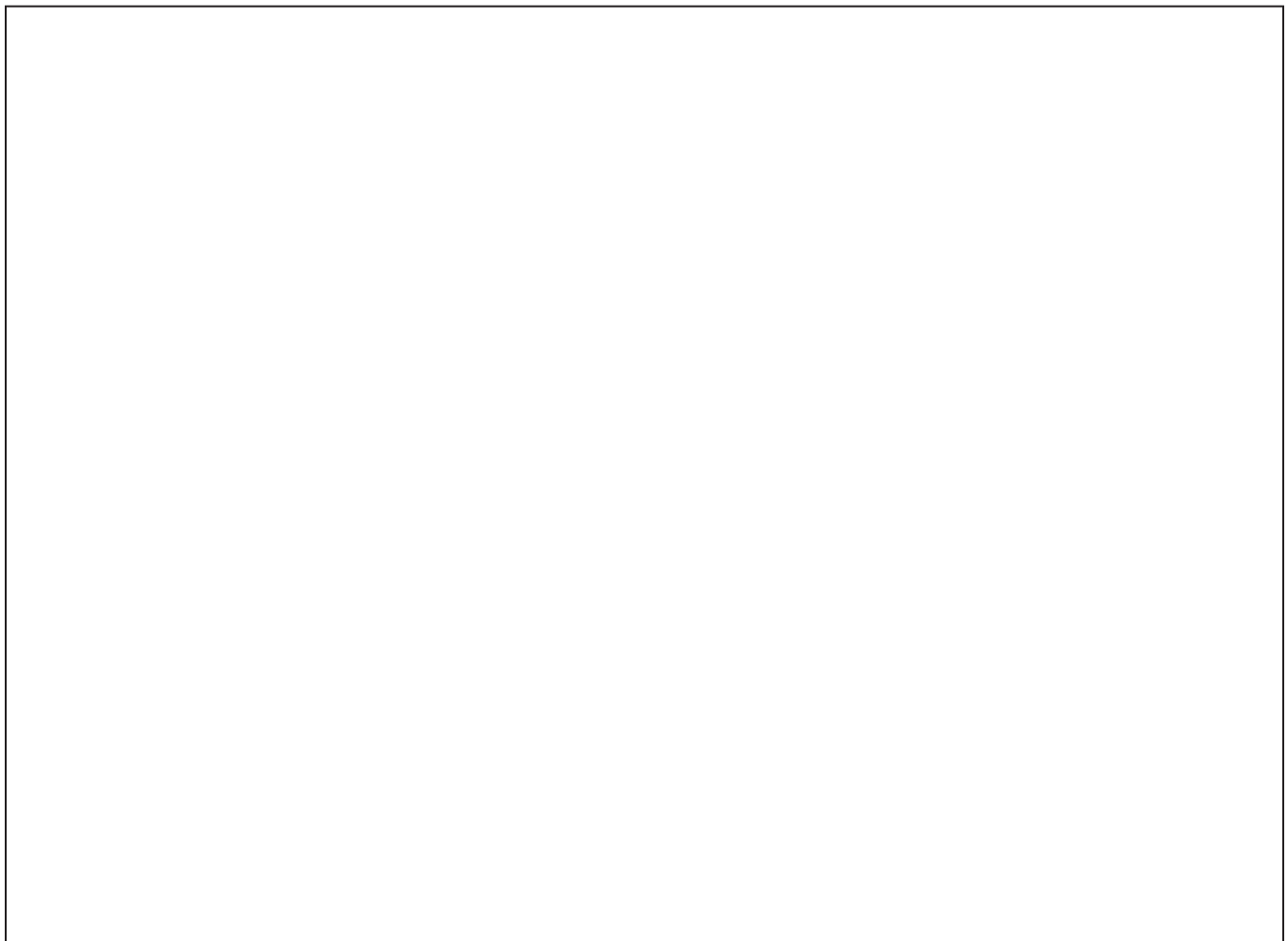


Name: _____ Date: _____

Daily Written Reflection

What happens to a sound when the amplitude of the sound wave changes?

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



Name: _____ Date: _____

Investigating Wavelength

1. Open the Custom Sound mode of the Sound Waves Sim.
2. Press Play to play a sound, and while the sound is playing, use the Wavelength slider to change the sound.
3. Observe what happens as you change the sound. Use your eyes and ears to make your observations.
4. Use what you observed to answer the questions below.

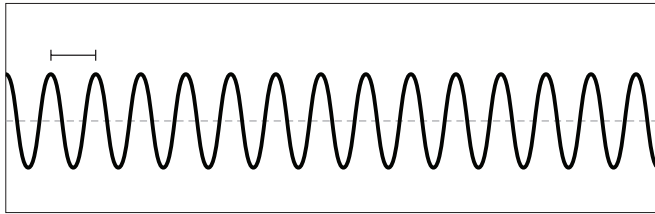
How does the sound change?

As the sound changes, what do you observe about the shape of the wave?

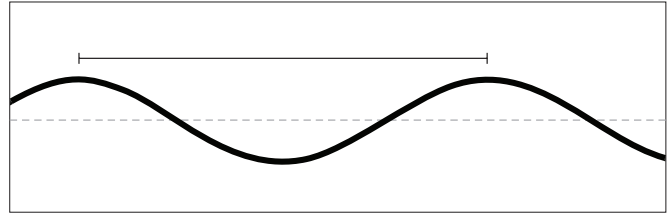
As you play sounds in the Sim and change the wavelength, look and listen for patterns. What patterns do you observe?

Daily Written Reflection

Below are waveforms for two sounds, Sound A and Sound B. Which of the two sounds has a higher pitch? How do you know?



Sound A



Sound B

Name: _____ Date: _____

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

Reading About Wavelength and Amplitude

1. Read the following sections of *Patterns in Communication* that contain information about both amplitude and wavelength:
 - Information That Travels as Waves (pages 6–7)
 - Treehopper Communication (pages 34–35)
2. As you read, don't forget to look carefully at the diagrams and images as well as the text.
3. After reading, answer the following questions.

How are wavelength and pitch related?

How are amplitude and volume related?

Name: _____ Date: _____

Reading About Wavelength and Amplitude (continued)

How do the sounds treehoppers make differ from one another?

Optional: Use the index to find another section that has information about either amplitude or wavelength. Read that section and record one thing you learned.

Name: _____ Date: _____

Think-Draw-Pair-Share: Drawing a Sound

1. Listen to the sound your teacher plays for you.
2. In the box below, draw what you think the waveform for the sound looks like.
3. Label the amplitude in one part of the waveform.
4. Label the wavelength in one part of the waveform.
5. Use your drawing to discuss your ideas with your partner.



Name: _____ Date: _____

Word Map: Waveform

My definition	Diagram
waveform	
Sentence	Example

Name: _____ Date: _____

Daily Written Reflection

Some scientists use visual representations of sound in their work. Why do you think using visual representations helps them?

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



Getting Ready to Read: *Seeing Sound*

1. Before reading the book *Seeing Sound*, 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.

_____ Many people use visual representations of sound in their jobs.

_____ Engineers study how animals use sounds to communicate.

_____ Doctors can sometimes use sound waves to help people who are sick.

_____ All people can hear low-pitched sounds and high-pitched sounds.

_____ It is not possible to change a sound once it has been recorded.

Why People Visualize Sound

1. As you read *Seeing Sound*, record some of the reasons why people visualize sound in their jobs.
2. Remember to look carefully at the visual representations in the book as well as reading the text.

Job	Why they visualize sound
Scientists	
Audiologists	
Doctors	
Sound engineers	

Multiple Meaning Words

Some words can mean more than one thing. For each word in the table:

1. Read the sentence from the book *Seeing Sound* 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
treat	Doctors can even use sound to treat their patients.	a special snack or sweet	to try to heal a disease
property	These scientists need to understand the properties of sound.	something someone owns	what you can see, hear, smell, taste, or feel about something
tone	One of these tests is called a pure tone test.	the pitch that a sound has	the way you say something
record	Sound engineers work with musicians to record music.	to use a computer or other machine to save a sound to listen to later	to draw or write information

Name: _____ Date: _____

Reading Reflection: *Seeing Sound*

Choose one job you read about and think about how people visualize sound in that job.

How is this **similar** to how you have visualized sound in your investigations?

How is it **different**?

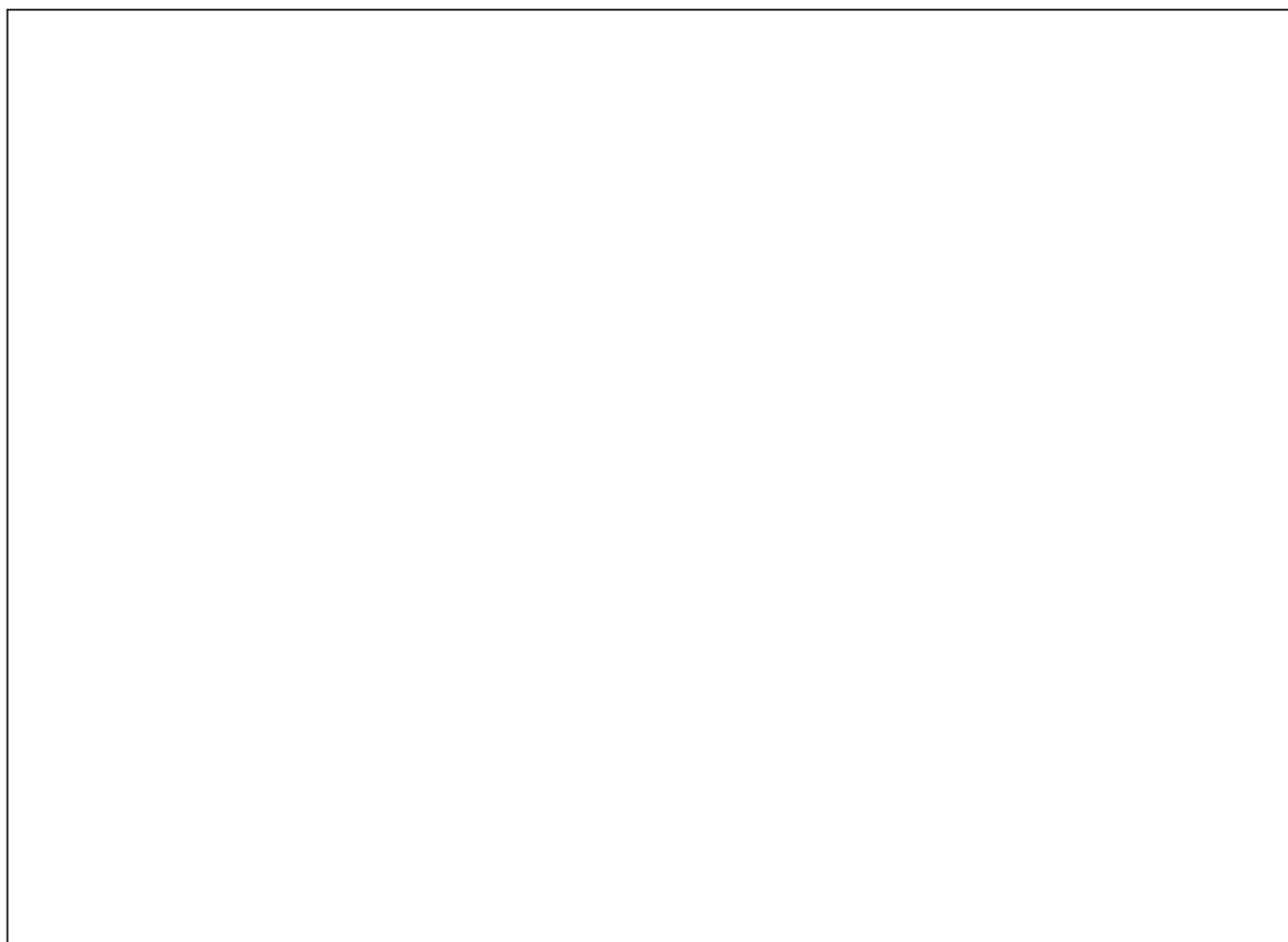
What questions do you have about sound after reading the book *Seeing Sound*?

Name: _____ Date: _____

Daily Written Reflection

What do you think it means to “crack a code”?

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



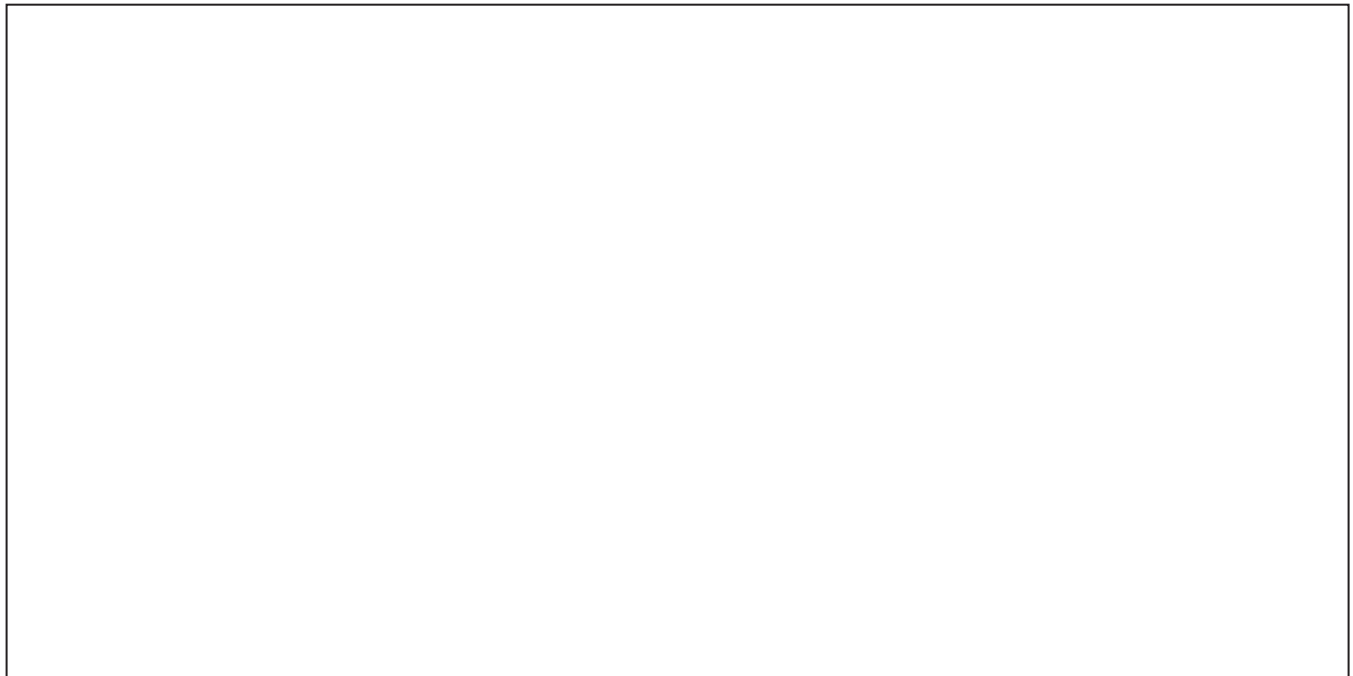
Name: _____ Date: _____

How Dolphins Use Different Sounds to Communicate

Write your answer to the question below based on what you read in *The Scientist Who Cracked the Dolphin Code*.

How can dolphins use different sounds to communicate with one another?

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



Name: _____ Date: _____

Getting Ready to Read:
The Scientist Who Cracked the Dolphin Code

1. Before reading the book *The Scientist Who Cracked the Dolphin Code*, 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.

_____ Dolphins make clicking, buzzing, and squeaking sounds.

_____ Dolphins communicate using very low-pitched sounds.

_____ It is easier for people to tell the difference in sound waves by listening to them than by looking at visual representations of them.

_____ Dolphins respond to changes in the pitch of a sound.

Multiple Meaning Words

Some words can mean more than one thing. For each word in the table:

1. Read the sentence from the book *The Scientist Who Cracked the Dolphin Code* 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
whistle	Each dolphin has a whistle that is different from every other dolphin's whistle .	a small device that makes a very loud, high-pitched sound when air is blown through it	a high-pitched sound made by blowing air through a hole
signature	Sayigh knew that bottlenose dolphins use signature whistles to stay in touch with each other.	a handwritten name	something that is special or unique
pattern	Humans are very good at grouping visual representations that show patterns of change in pitch.	something that we observe to be the same over and over again	a decorative design

Name: _____ Date: _____

Reading Reflection:
The Scientist Who Cracked the Dolphin Code

If you could meet Laela Sayigh, what questions would you ask her about her dolphin research?

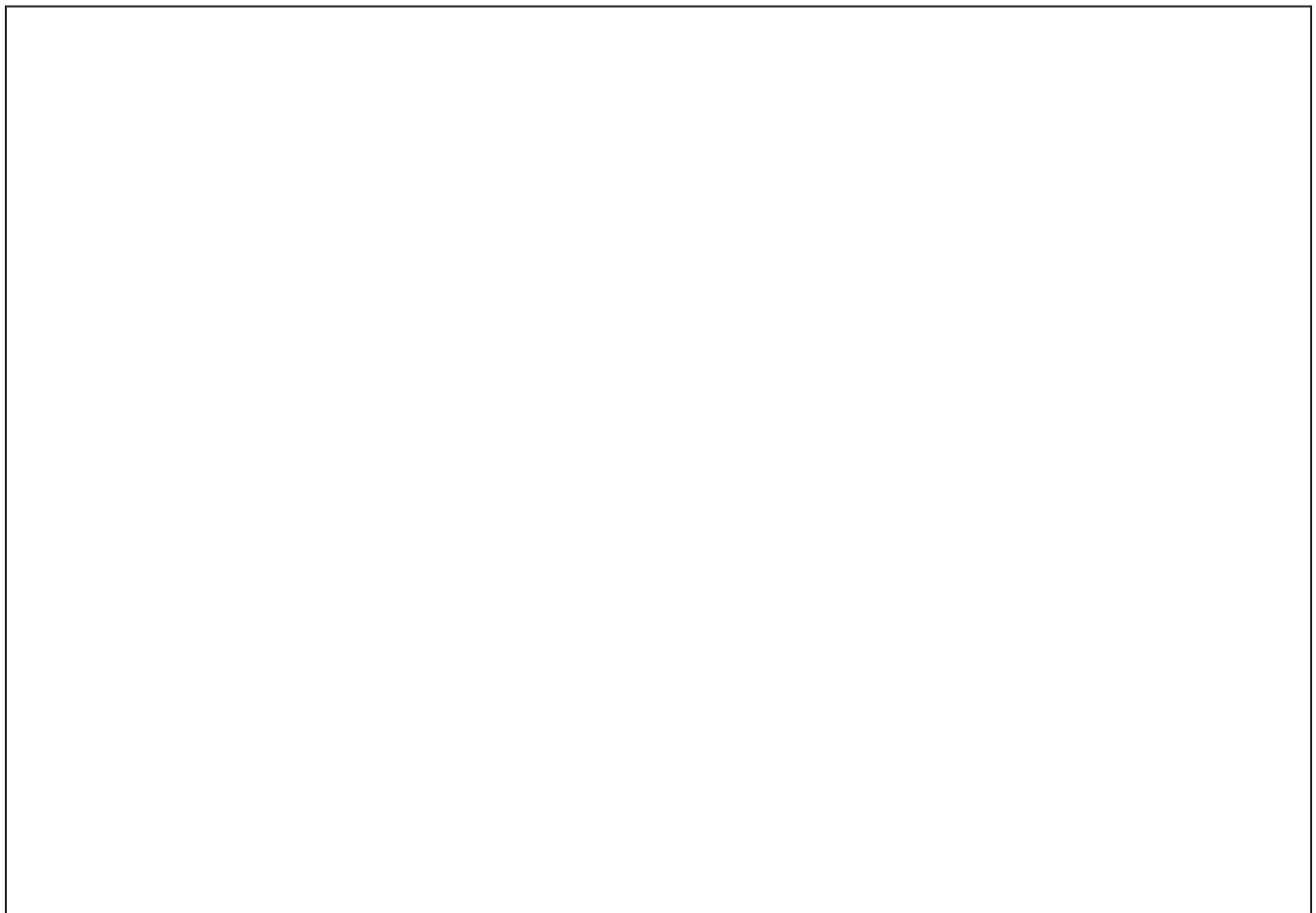
People all over the world are studying how dolphins use sound to communicate. What would you like to know about how dolphins communicate?

Name: _____ Date: _____

Daily Written Reflection

Think of an animal that uses sounds to communicate. Describe the animal's sounds and what message the animal is sending.

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



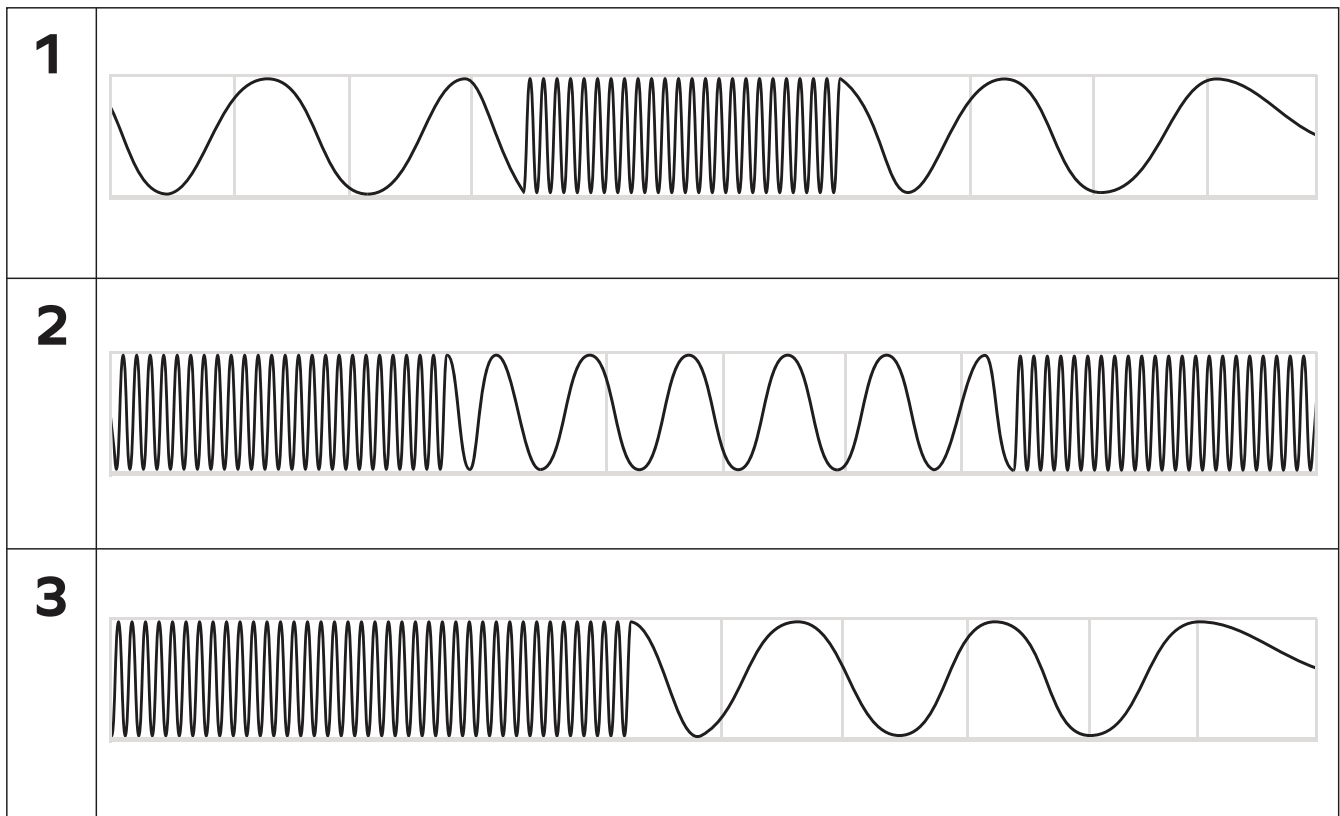
Name: _____ Date: _____

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

Dolphin Signature Whistles

Below are waveforms for three dolphin signature whistles (1, 2, and 3).

1. Discuss the following questions with your partner.
 - What differences do you notice between the waveforms?
 - What do you think each whistle sounds like?
2. When your teacher assigns you a signature whistle, circle the number to the left of the waveform. Don't show your classmates which whistle is yours!
3. Label the amplitude and wavelength on your signature whistle.



Name: _____ Date: _____

Simulating Dolphin Signature Whistles

1. Open the Custom Sound mode of the Sound Waves Sim.
2. Using the waveform for your whistle on page 70 as a guide, make your signature whistle in the Sim. (This might take a few tries!)
3. Make and listen to your signature whistle a few more times until you think you can recognize the sound.
4. Answer the questions below.

Describe what the waveform for your signature whistle looks like. Use words such as *long*, *short*, and *wavelength*.

Describe what your signature whistle sounds like. Use words such as *high*, *low*, and *pitch*.

Name: _____ Date: _____

Preparing for a Science Forum

Write notes about the questions below to prepare for the Science Forum.

How does a mother dolphin’s call get to her calf?

What evidence supports your ideas about how a mother dolphin’s call gets to her calf?

How does a dolphin calf know which call is his mother’s call?

What evidence supports your ideas about how a dolphin calf knows which call is his mother’s call?

Name: _____ Date: _____

Scientific Language to Use During the Science Forum

I think _____.

It seems to me _____.

My evidence is _____.

I agree because _____.

I disagree because _____.

This idea is important because _____.

Word Map: Pattern

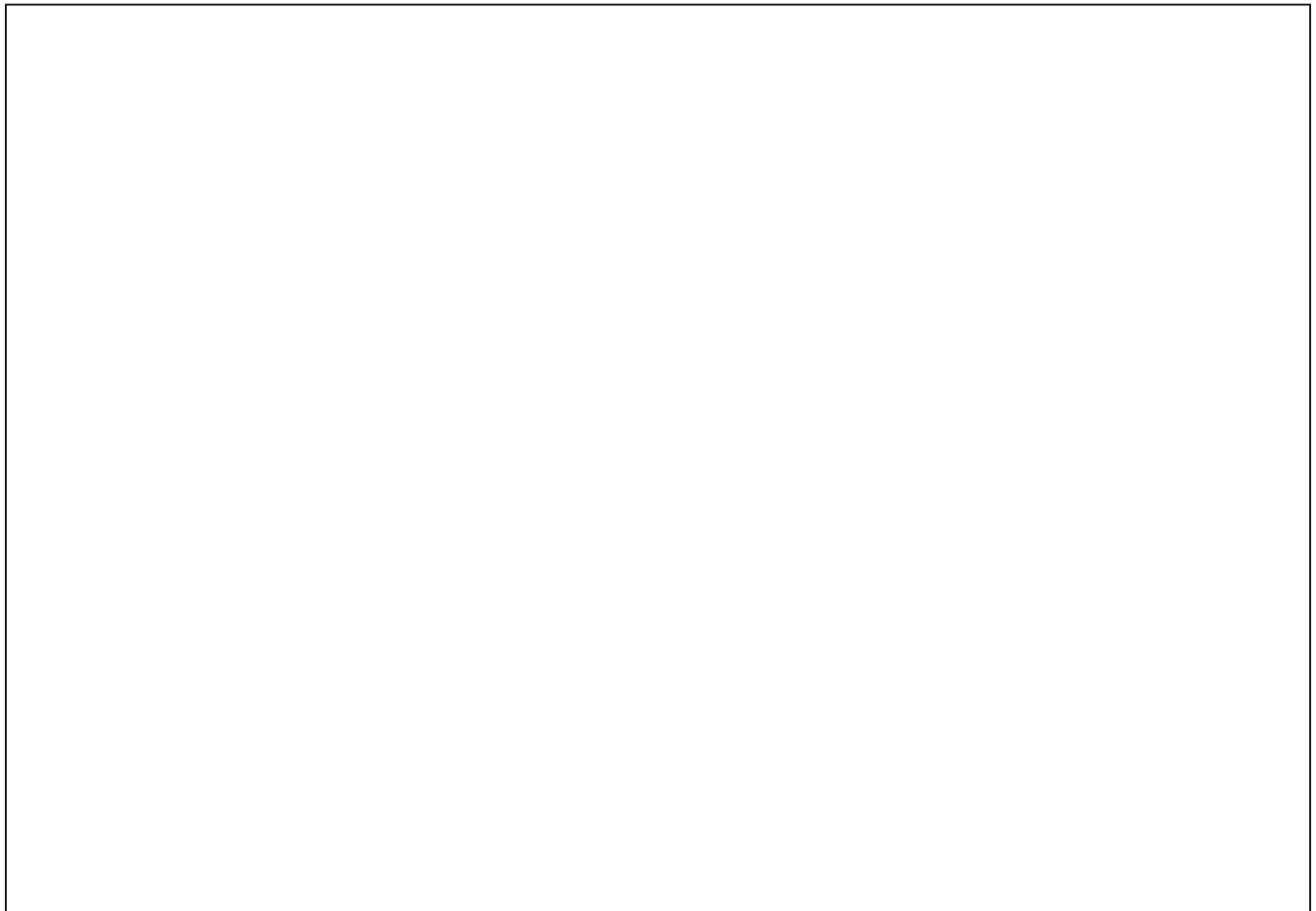
My definition	Diagram
pattern	
Sentence	Example

Name: _____ Date: _____

Daily Written Reflection

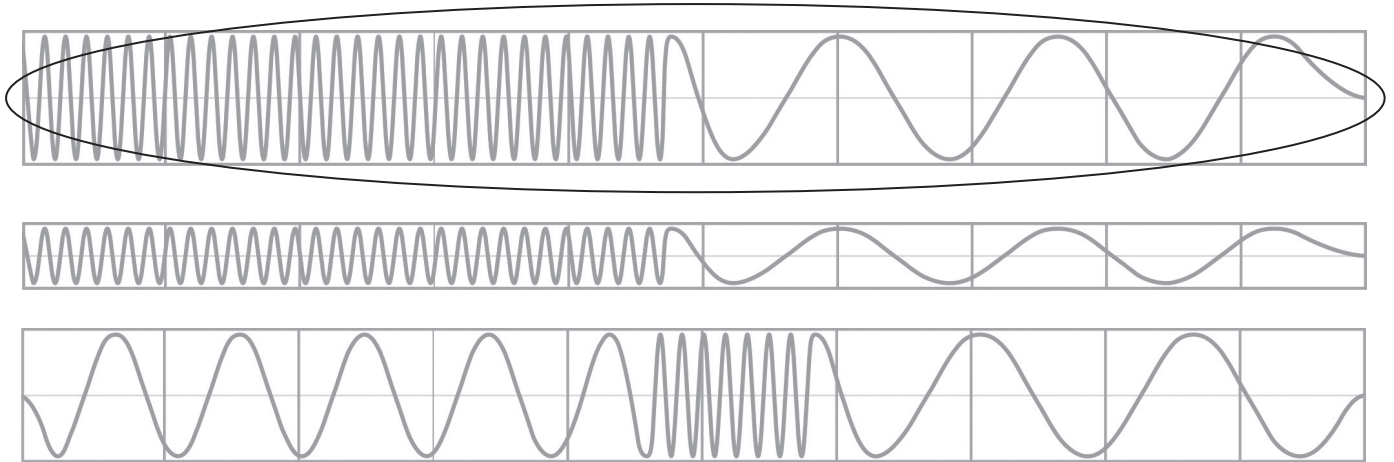
What questions do you still have about how dolphins communicate with one another?

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



Scientific Explanation of How Dolphins Communicate

1. Look at the waveforms below and read the information about them.
2. Write a scientific explanation for the two questions below.



- Two of these waveforms show calls from the mother dolphin, and one waveform shows a call from another dolphin.
- The circled waveform is the call that the dolphin calf heard and responded to.

How was the dolphin calf able to hear his mother even though he was really far away?

Name: _____ Date: _____

Scientific Language for Explanations

The mother dolphin's call gets to her calf because _____.

The calf knows which call is his mother's call because _____.

This means _____.

This happens because _____.

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 explain how or why something happens. Am I getting closer to figuring out how a mother dolphin can communicate with her calf underwater?

I understand how sound gets from a mother dolphin to her calf. _____ Yes _____ Not yet

I understand what travels far in a sound wave and what moves only a little. _____ Yes _____ Not yet

I understand how sound energy travels through the particles of a material. _____ Yes _____ Not yet

I understand why some dolphin sounds are different from other dolphin sounds. _____ Yes _____ Not yet

I understand that science explanations describe how or why something happens. _____ Yes _____ Not yet

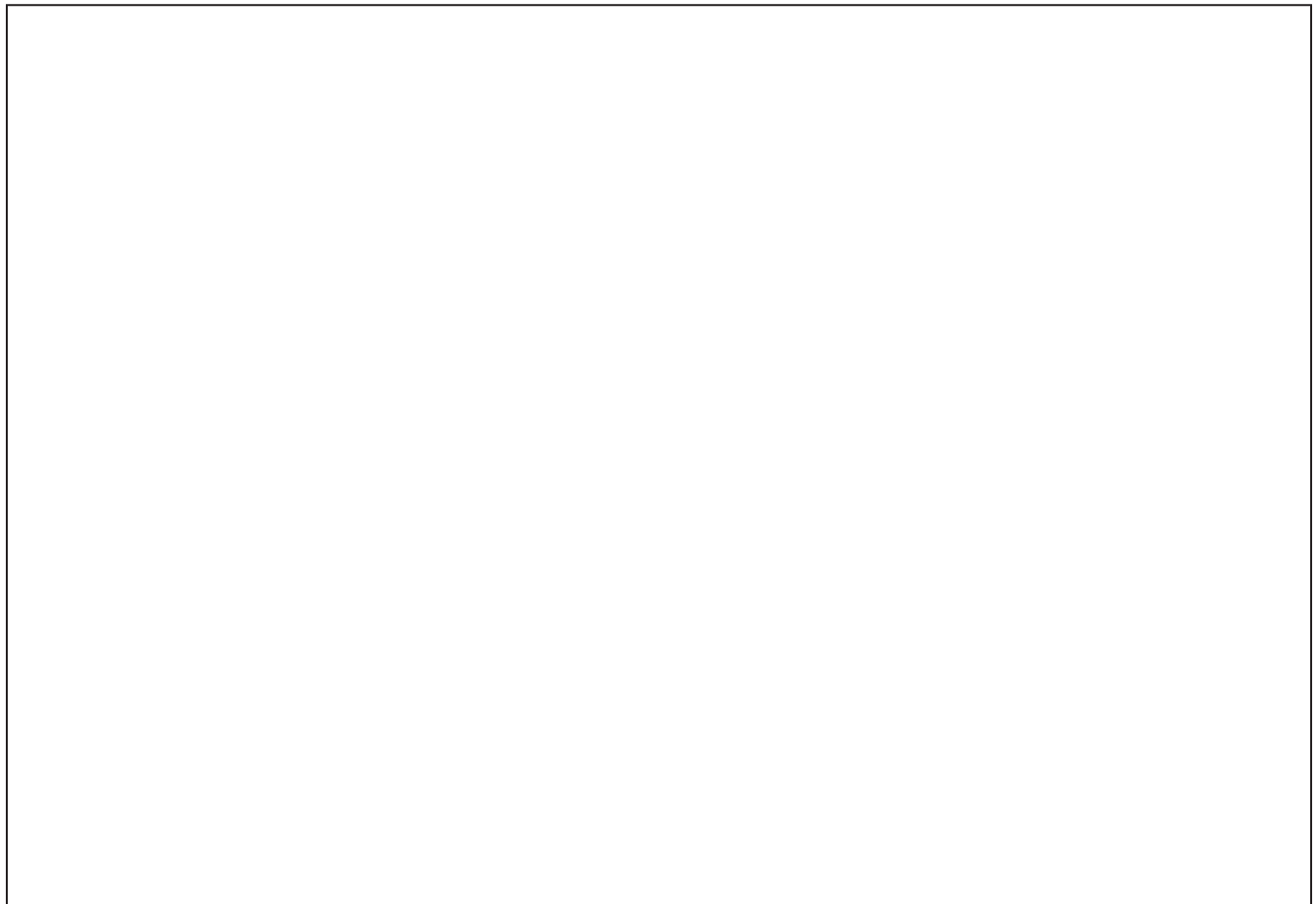
What are you still wondering about sound waves?

Name: _____ Date: _____

Daily Written Reflection

What are some ways that you could communicate with someone who lives in another state or country?

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



Sending an Image

On this page, you will make an image that you will send to a partner.

1. In the grid below, fill in some of the squares to make an image (for example, a letter, a number, or a shape).
2. Make sure none of your classmates see your image.
3. Once your teacher gives the signal to do so, describe your image to your partner so they can re-create it.
4. When you are sending your image, you may talk, but your partner may not talk.

Your Image

Name: _____ Date: _____

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

Receiving an Image

On this page, you will re-create your partner's image.

1. Listen to your partner's description of the image.
2. In the grid below, fill in squares to re-create your partner's image.
3. Do not look at your partner's image, and do not let your partner look at your image.
4. Do not talk while your partner describes the image.

Your Partner's Image

Name: _____ Date: _____

Patterns in Human Communication

As you read the sections about human communication in *Patterns in Communication*, record information about how each communication method uses patterns.

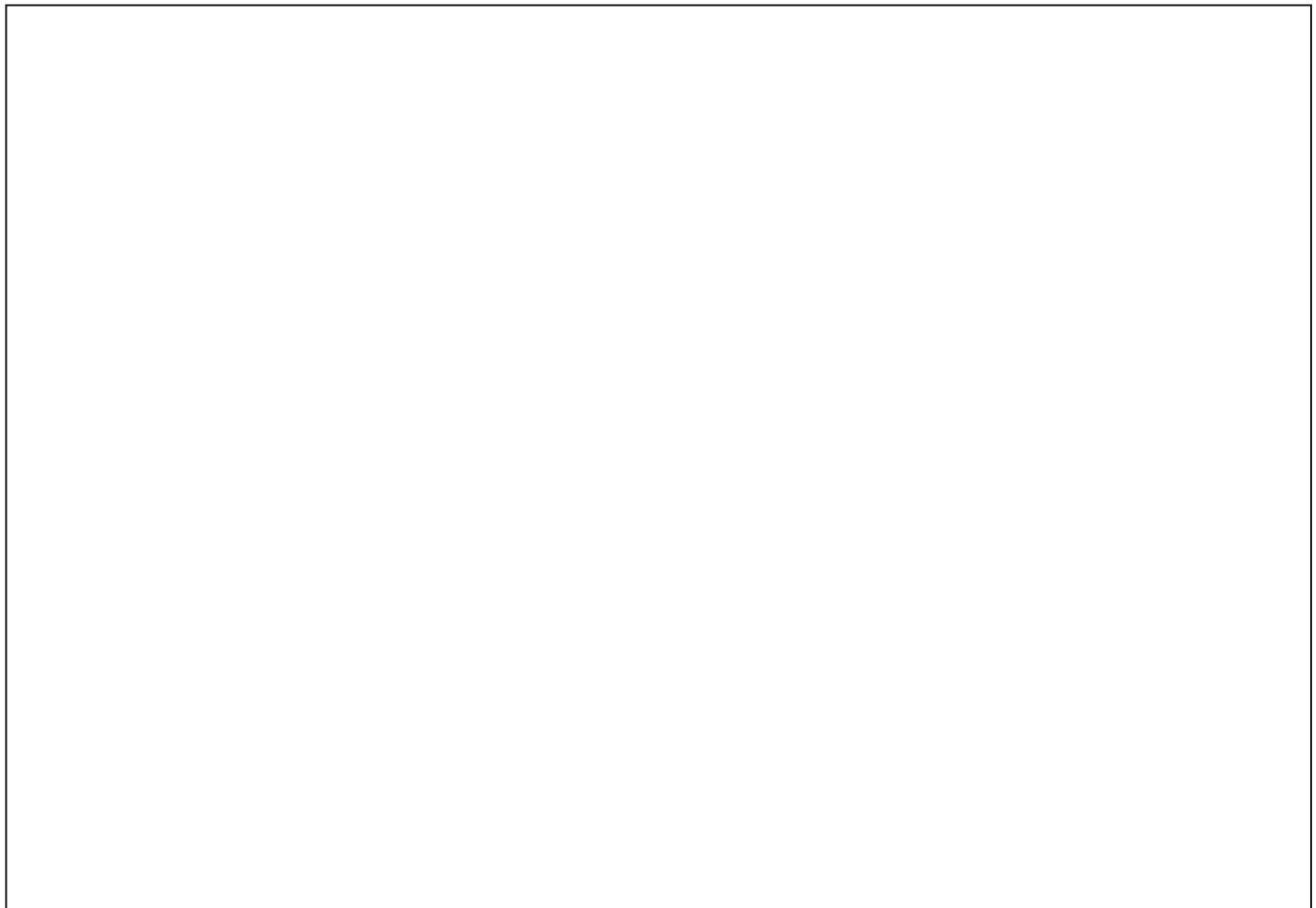
Communication method	What patterns does it use?
Language	
Talking drums	
Semaphore	
Telegraph	
Digital devices	

Name: _____ Date: _____

Daily Written Reflection

Think of and describe an example of a code that you have used or that you know about. What was the code used for?

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

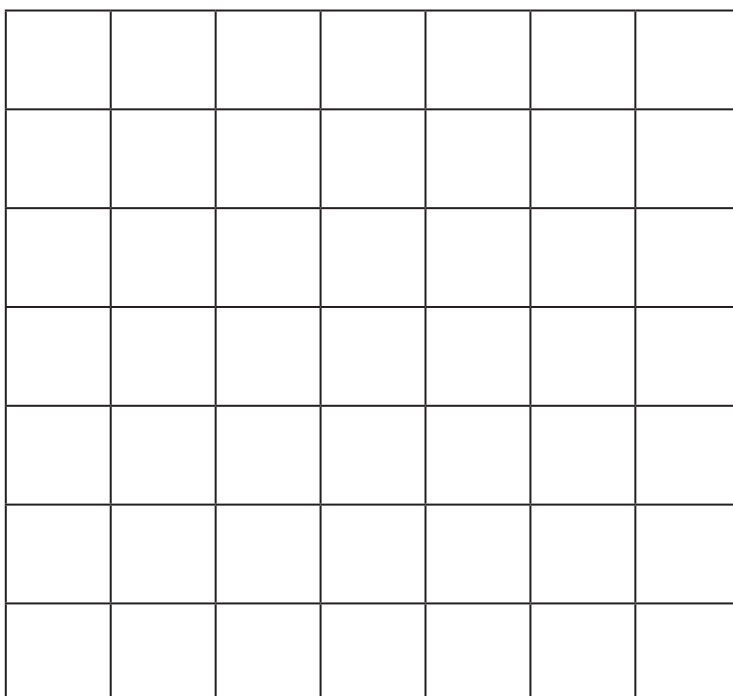


Name: _____ Date: _____

Decoding Your Teacher's Image

1. Your teacher will read you a binary code.
2. Use the code to re-create the image in the grid below. Start with the square in the top left of the grid.
3. The code is: 1 = black, 0 = white.

Your Teacher's Image



Name: _____ Date: _____

Decoding Your Teacher's Image (continued)

How similar was your image to your teacher's image?

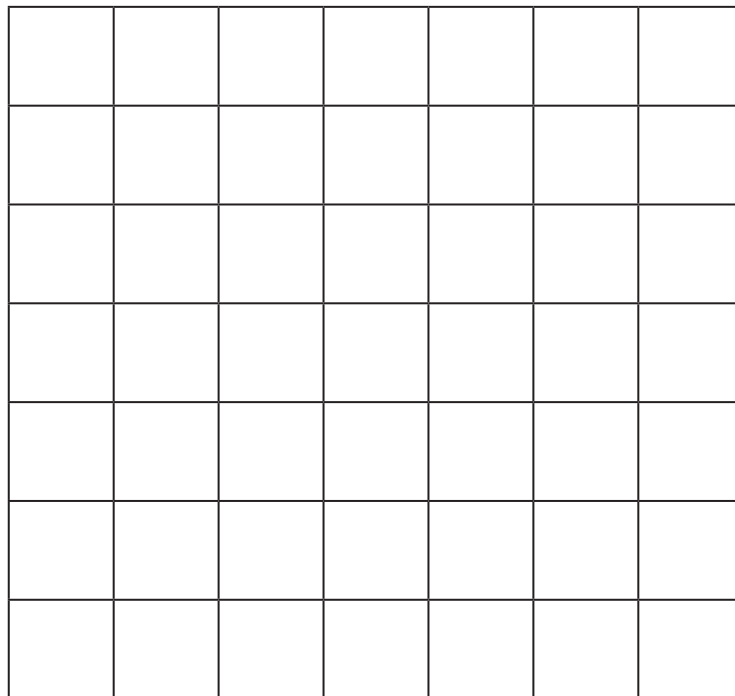
Was using binary code easier or harder than describing your image to your partner in the previous lesson? Why do you think so?

Encoding an Image

On this page, you will make an image that you will send to a partner in binary code.

1. In the grid below, fill in some of the squares to make an image. Don't show the image to your partner.
2. Use the Code Communicator Tool to encode your image into binary code. Record the code on the lines below the grid.
3. Read the code to your partner to see if they can decode your image.
4. You may only say the words *one* and *zero* to your partner.

Your Image



Binary Code for Your Image

Name: _____ Date: _____

Decoding an Image

On this page, you will re-create your partner's image.

1. In the grid below, use the code your partner reads to fill in the squares to re-create the image. Remember that the code is: 1 = black, 0 = white.
2. Do not look at your partner's image.
3. Do not talk while your partner reads the code.

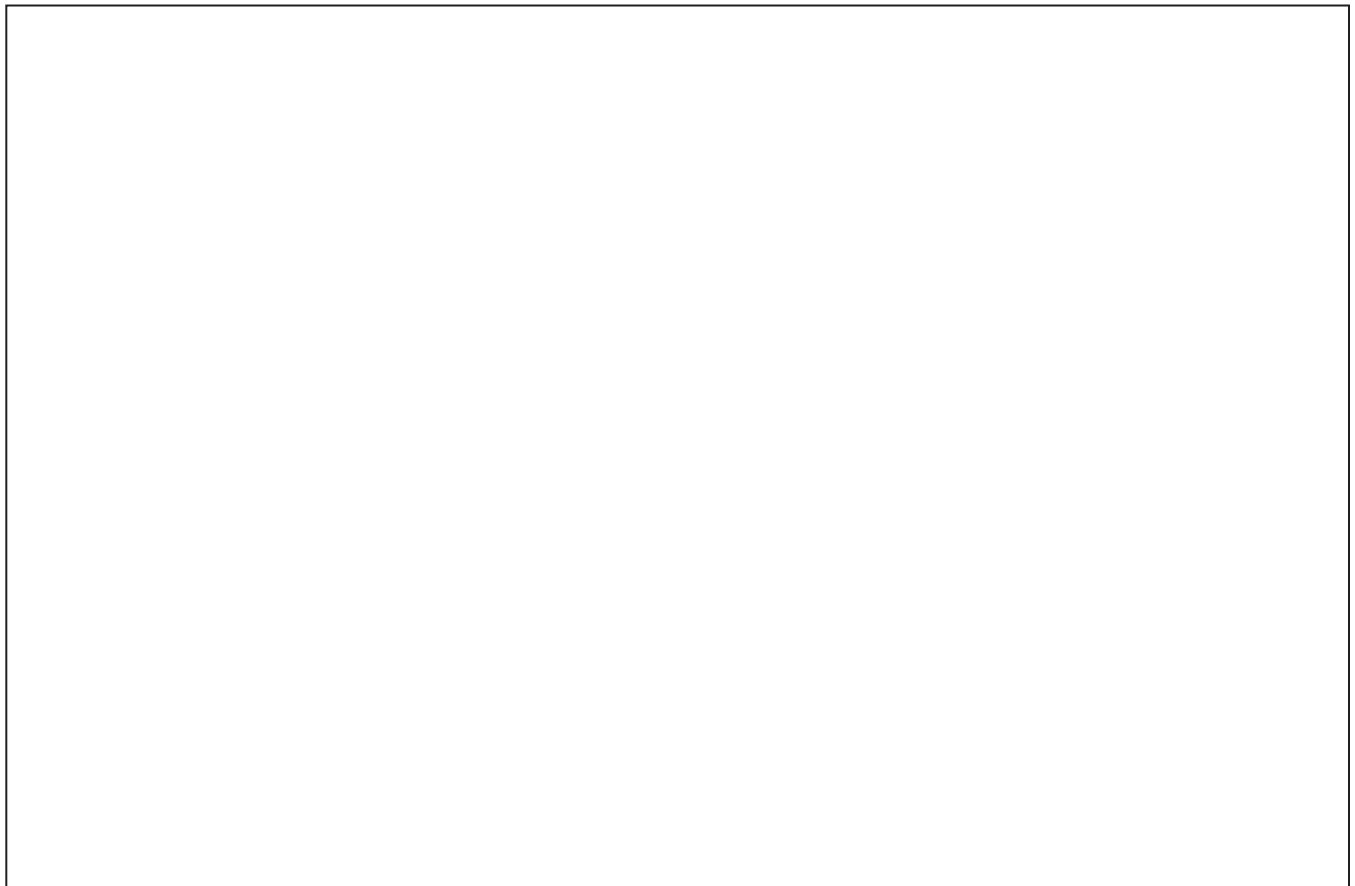
Your Partner's Image

Name: _____ Date: _____

Daily Written Reflection

If you wanted to send a message to someone across the classroom, how could you do it? Describe three different ways you could send your message.

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.

Code Challenge

Part 1: Encoding an Image

1. Make an image in the Code Communicator Tool with your partner.
2. In the grid below, fill in squares to make a record of your image. Be sure to keep your image secret from the rest of your classmates!
3. In the Code Communicator Tool, turn on the Show Binary toggle to encode your image.
4. Record the code on the lines below the grid.
5. When you have finished making your image and recording the binary code, answer the question on the next page.

Your Image

Binary Code for Your Image

Name: _____ Date: _____

Code Challenge

Part 1: Encoding an Image *(continued)*

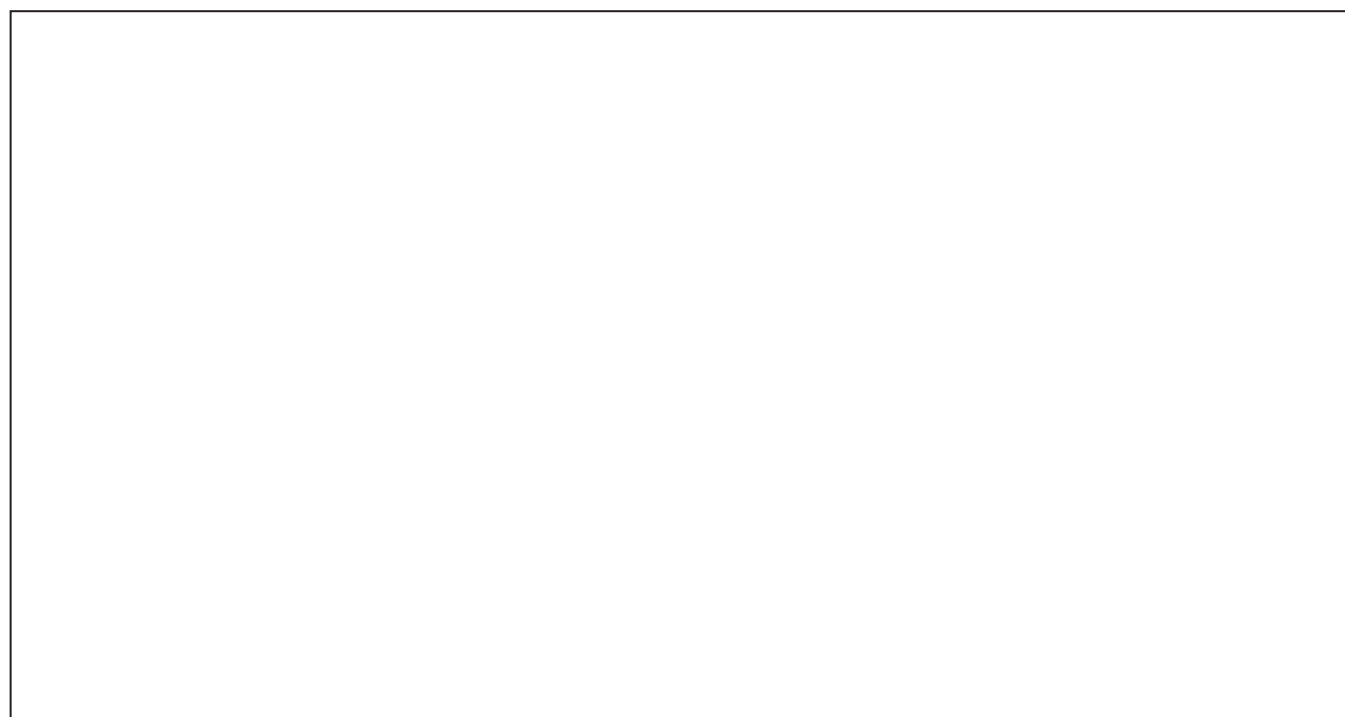
How do you think binary code will be helpful for sending a message across the room?

Name: _____ Date: _____

Communication Plan

With your group, discuss how you will send the code for your image across the room. When you have decided on a plan, write a description of what you are going to do.

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

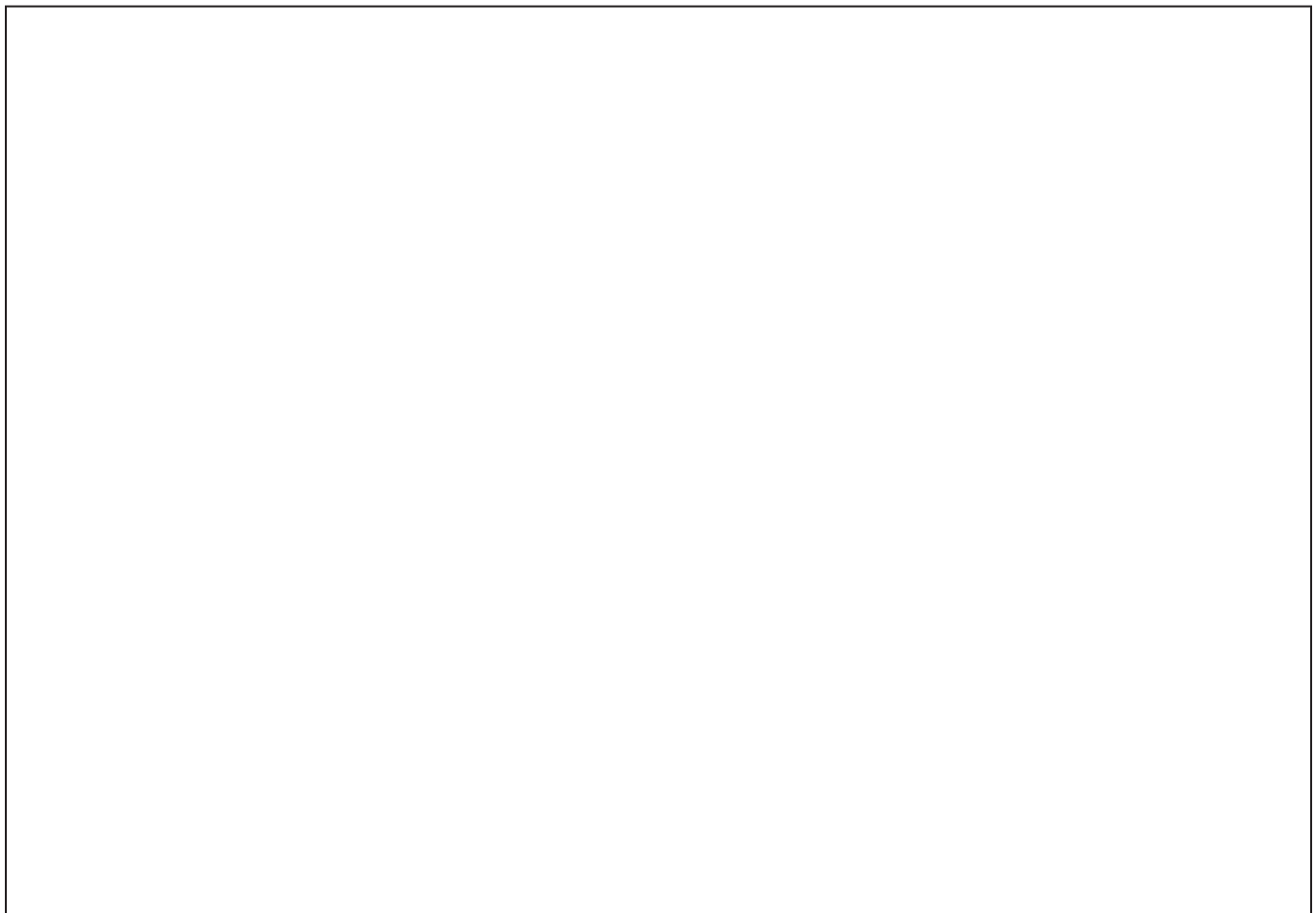


Name: _____ Date: _____

Daily Written Reflection

What have you learned about how digital devices send messages across long distances? What questions do you still have?

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



Name: _____ Date: _____

Code Challenge

Part 2: Sending and Decoding Images

1. Senders and receivers stand on opposite sides of the room.
2. Senders: Partner A reads the binary code from page 92 to Partner B. Partner B sends the code across the room.
3. Receivers: Partner A watches for the code from the senders. Partner B enters the code into the Code Communicator Tool.
4. Be sure to keep the image you received on your screen to show the rest of your group later.
5. Senders and receivers switch roles.

Name: _____ Date: _____

Reflecting on the Code Challenge

1. Compare the image you decoded with the image that was sent to you.
2. Discuss the questions below with your group and record your ideas.

How accurate was the image you decoded compared with the original image? Why do you think so?

How is what you did for the Code Challenge similar to the way digital devices send and receive information?

In what ways do you think binary code is useful for communicating across distances?

Name: _____ Date: _____

Chapter 4: Check Your Understanding

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

Scientists investigate in order to explain how or why something happens. Am I getting closer to figuring out how humans can use patterns to communicate?

I understand some ways that humans communicate.

_____ Yes _____ Not yet

I understand how digital devices send and receive messages.

_____ Yes _____ Not yet

I understand how binary code can be useful for communication.

_____ Yes _____ Not yet

I understand that science explanations describe how or why something happens.

_____ Yes _____ Not yet

What are you still wondering about human communication?

Glossary

amplitude: how big or loud a wave is

amplitud: cuán grande o fuerte es una onda

collision: two or more things bumping into each other

colisión: dos o más cosas que se golpean entre sí

communicate: to share information

comunicar: compartir información

energy: the ability to make things move or change

energía: la capacidad de hacer que las cosas se muevan o cambien

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

explicación: una descripción de cómo algo funciona o por qué algo pasa

investigate: to try to learn more about something

investigar: intentar aprender más acerca de algo

material: the stuff that makes up everything

material: lo que constituye todo

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

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

particle: a tiny piece of material that is too small to see

partícula: un pedacito de material que es demasiado pequeño para ver

pattern: something we observe to be similar over and over again

patrón: algo que observamos que sea similar una y otra vez

Glossary (continued)

source: the place where something comes from

fuelle: el lugar desde donde viene algo

transfer: to move something from one place to another

transferir: mover algo de un lugar a otro

vibrate: to move back and forth quickly

vibrar: mover hacia adelante y hacia atrás rápidamente

visualize: to make a picture in your mind using information from different sources

visualizar: hacer una imagen en tu mente con información de diferentes fuentes

wave: a pattern of motion that travels away from a source

onda: un patrón de movimiento que viaja alejándose de una fuente

waveform: a curved line that shows the pattern of a wave

forma de onda: una línea curva que muestra el patrón de una onda

wavelength: the distance from one peak of a wave to the next

longitud de onda: la distancia que hay desde un pico de onda hasta el siguiente

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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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