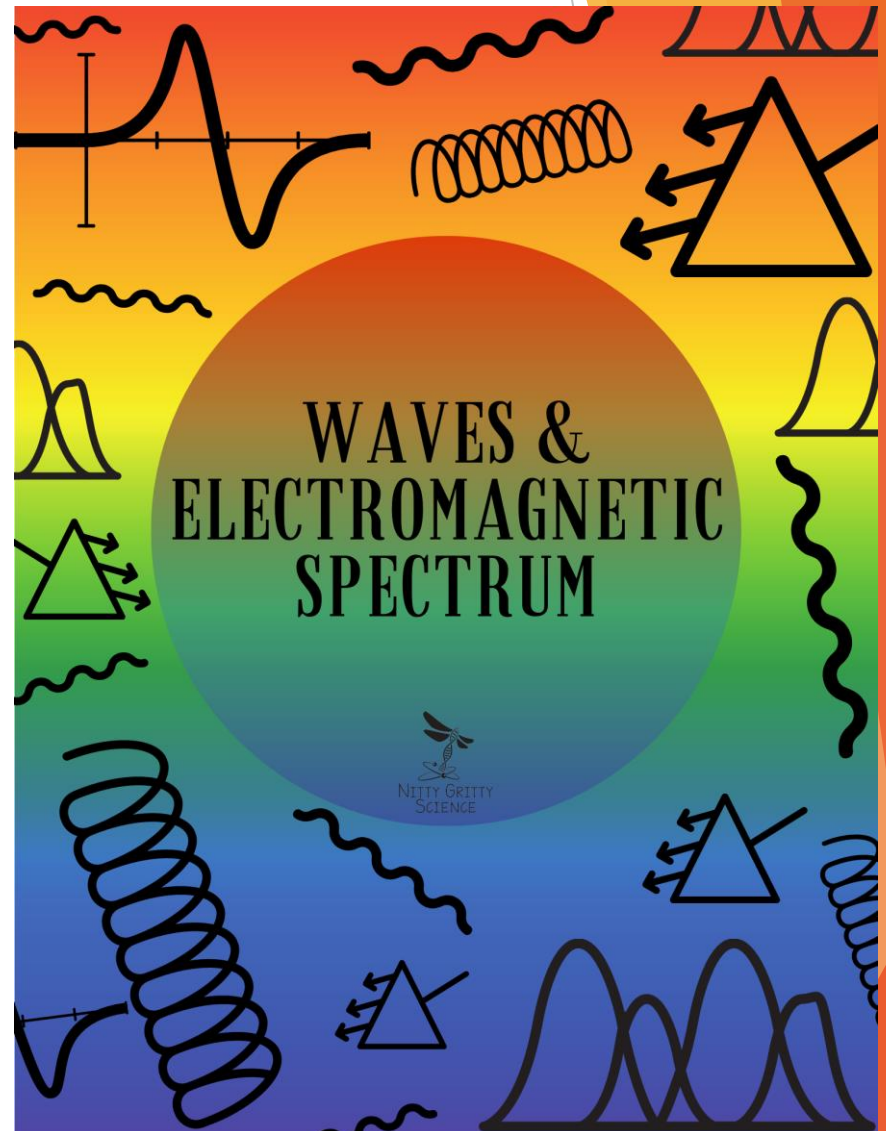


# Waves & The Electromagnetic Spectrum

Waves & The Electromagnetic Spectrum Unit

includes:

- Print and digital Interactive Notebooks
- Editable Resources including notes, PowerPoints, and test
- Instructional Videos
- Teacher-led Demos & Guided Inquiry Labs
- Task Cards & Digital Task Cards
- Study Guides



# Suggested Pacing Guide



The following is a **suggested pacing guide** for my COMPLETE COURSES (Earth, Life or Physical Science) which are based on 50-minute class periods. There are three variations below. Each variation is based on the **number of sections in your SCIENCE INTERACTIVE NOTEBOOK chapter**.

Based on a **4-Section Chapter**

Day	Lesson/Activity	Engage	Explain	Explore	Elaborate	Evaluate
1	• Teacher Demo	x				
	• Section 1 Notes – INB input		x			
	• INB Activity – INB output (homework if not completed in class)			x		
2	• Mini-quiz					x
	• Section 2 Notes – use PowerPoint		x			
	• INB Activity			x		
3	• Mini-quiz					x
	• Guided Inquiry Lab – Student Led			x		
4	• Section 3 Notes – use PowerPoint		x			
	• INB Activity			x		
5	• Mini-quiz					x
	• Section 4 Notes – use PowerPoint		x			
	• INB Activity			x		
6	• Mini quiz					x
	• Science Stations				x	
7	• Science Stations				x	
8	• Final draft and testing for Creation Station (STEM)				x	x
9	• Task Card Review (game-style, full class, partner)				x	
10	• Chapter Test					x
	• Have students complete notes for next chapter*	x				

\* **Note-taking option:** Once students are done with chapter test, they get the next set of notes and work quietly on completing them while other students finish up. All notes are to be completed when they return to class. Have students glue each page of notes into the next few pages of their INB (right side only). This way, when you go over the PowerPoint each day, they have already reviewed topic and are ready for class.

## 5 E Model

**Engage** – Teacher-led demos foster wonder and classroom discussion and serve as the hook for the lesson. Videos and images of natural phenomena also foster questioning and communication. NGSS phenomena are aligned to middle school NGSS standards.

**Explain** – PowerPoints, instructional videos, and guided notes (input side of interactive notebooks) provide definitions, explanations, and information through mini-lecture, text, internet, and other resources which encourages students to explain concepts and definitions in their own words.

**Explore** – Students investigate problems, events, or situations. As a result of their mental and physical involvement in these activities, students question events, observe patterns, identify and test variables, and communicate results.

**Elaborate** – It is important to involve students in further experiences that apply, extend, or elaborate the concepts, processes, or skill they are learning. Elaborate activities provide time for students to apply their understanding of concepts and skills. They might apply their understanding to similar phenomena or problems.

**Evaluate** – Use a variety of assessment to gather evidence of student's understanding and provide opportunities for them to assess their own progress.

# Student Interactive Notebook

Each concept shares:

- Actual photos of both the INPUT and OUTPUT pages of Science Interactive Notebook
- Instructions on how to create/use/complete activity for OUTPUT side
- Mini-Quizzes for each concept to check students' understanding
- Answer Keys for all mini-quizzes
- Appendix with Teacher Notes for Interactive Notebook in LARGE print.

**Section 1: Waves**

Directions: Using the following terms or phrases, complete the concept map on Waves, and then cut out and paste into your Science Interactive Notebook.

Medium Energy Matter or Space Mechanic

Name \_\_\_\_\_ Date \_\_\_\_\_

**Quiz Waves**

Multiple Choice

1. A wave will travel only as long as it has \_\_\_\_\_ to carry  
 a. mass      b. matter      c. energy      d. speed

2. \_\_\_\_\_ are produced by \_\_\_\_\_  
 a. vibrations      b. sound      c. light

3. \_\_\_\_\_ squeeze spring coils together then release them, you are \_\_\_\_\_ wave.

**Section 2: Features of Waves**

Directions: Cut on the dotted lines then paste sheet into Science Interactive Notebook. Fold Flaps up then write in proper vocabulary term where they belong on each wave.

**Wave Vocabulary**

Crest      Wavelength      Rest position      Trough      Amplitude  
 Compression      Rarefaction

**Section 3: Behavior of Waves**

**Refraction of Light**

**Objective:** To observe the refraction of light waves.

**Materials:**

- Prism
- Flashlight
- Scissors
- Tape
- Cardboard
- Pencil
- Beaker
- Water

**Directions:**

**Part 1**

1. Cut a piece of cardboard to fit over the light source of the flashlight.
2. Cut a slit in cardboard about 3 cm long and 2mm wide.
3. Darken the room and shine flashlight beam so that it strikes the prism.
4. Rotate prism until a pattern of colors is produced, the white paper where the pattern appears so you can observe colors.
5. Draw your observations (include flashlight beam, prism, and pattern of colors) on your recording sheet.

**Part 2**

6. Fill the beaker half-way with water.
7. Place a pencil in the beaker and observe appearance of pencil. Is the pencil bent? Is the pencil's appearance at level the same as the water level?
8. Draw your observations on your recording sheet.
9. Answer all questions on recording sheet, and then paste your recording sheet into your Science Interactive Notebook.

**Instructions:**

For this page in the Science Interactive Notebook, you will need a variety of materials. A variety of materials are needed, including a flashlight, a piece of cardboard, a pencil, a beaker, and water. Students will need to draw their observations of the behavior of light waves they saw.

The following are the directions for the investigation, student recording page 0

**Refraction of Light**

Define Refraction:

Observations:

Prism Spectrum	Pencil in Water

Explain the behavior of light waves when they strike the:

Prism \_\_\_\_\_

Water \_\_\_\_\_

Give two real-world examples of refraction of light:

1. \_\_\_\_\_
2. \_\_\_\_\_

**Quiz Behavior of Waves**

Name \_\_\_\_\_ Date \_\_\_\_\_

Matching

1. Refraction      a. when two or more waves overlap and combine to form a new wave
2. Diffraction      b. wave strikes an object and bounces off
3. Reflection      c. bending of wave caused by moving from one medium to another
4. Interference      d. angle of incidence of a wave is always equal to the angle of reflection
5. Law of Reflection      e. original wave bends to change direction and bend toward it
6. Converge and contrast: refraction and diffraction

**Section 4: Behavior of Waves**

Name \_\_\_\_\_ Date \_\_\_\_\_

**Quiz Behavior of Waves**

Matching

1. Refraction      a. when two or more waves overlap and combine to form a new wave
2. Diffraction      b. wave strikes an object and bounces off
3. Reflection      c. bending of wave caused by moving from one medium to another
4. Interference      d. angle of incidence of a wave is always equal to the angle of reflection
5. Law of Reflection      e. original wave bends to change direction and bend toward it
6. Converge and contrast: refraction and diffraction

# Student Digital Notebook

The student notebook is on Google Drive and ready for you to share with your students. Here's a quick overview of the features:

Set up like a traditional interactive notebook with input and output sides.

Hyperlinked tabs so student can easily move through chapter for review

Students watch video < 6 min to complete notes.

Directions: Answer the questions using the Seismic Waves Viewer and the "More on Seismic Waves" link below. This viewer shows an earthquake and the path that the seismic waves take as they travel away from the epicenter.



[MORE ON SEISMIC WAVES](#)

**SEISMIC WAVES**

Label each layer and what medium its made of.

Why do p-waves refract and slow down at the core/mantle boundary?

Why will s-waves never travel through the core?

**WAVES**

Wave -

All waves carry \_\_\_\_\_ without transporting \_\_\_\_\_ from place to place.

Waves move energy not matter so the boat will stay in the same place or move forward?

Medium -

A medium can be \_\_\_\_\_ or \_\_\_\_\_ or a combo of these.

Not all waves need a medium to travel \_\_\_\_\_ and \_\_\_\_\_ waves can travel through space.

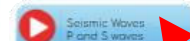
Mechanical waves -

Transverse waves | Compressional waves



Digital Textbook

For further exploration, click button(s) below.



Encouraging independent learners. Directions for output side are here along with what they need to complete the activity.

Notes are chunked into manageable sections with large spaces for textboxes

Some pages have links so students can go deeper into the topic if they need.



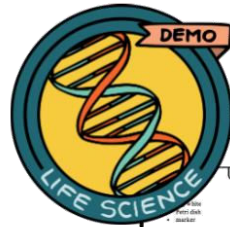
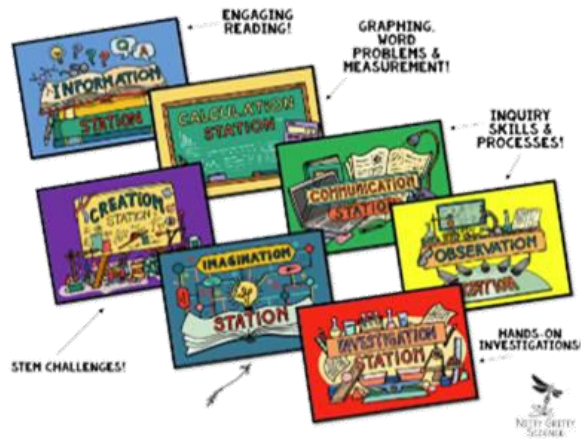
# Demos, Labs, & Science Stations

Working in the lab and being engaged in science experiments is the most exciting part of science.

Demo, Labs, and Science Stations Includes:

1. **SCIENCE STATION SIGNAGE** for all 7 stations is provided in color and in black and white (see preview) and all student answer sheets have icons that correspond with each station for ease of use.
2. **DEMONSTRATION** (teacher-led) allows teachers to invite scientific discussions and can help uncover misconceptions and, most importantly, lead to heightened curiosity and interest in the topic being studied.
3. **GUIDED INQUIRY LAB** which is a traditional lab that allows students to perform an investigation in order to solve a problem. Students will hypothesize, collect and analyze data and communicate their results.
4. **TEACHER GUIDES to DEMOS & SCIENCE STATIONS** help get you started and give you background information to make your science lessons engaging.
5. **7 SCIENCE STATIONS** which are designated locations in the classroom with activities that challenge students to extend their knowledge and elaborate on their science skills by working independently of the teacher in small groups or pairs. Stations included are:
  - **INFORMATION STATION** – Group members will read an interesting and relevant science passage then complete a task to help increase science literacy and deepen their understanding of the science concept.
  - **OBSERVATION STATION** – Group members will have images, illustrations, or actual samples at this station that show applications or processes of the science topic. Using what they've learned, they will need to apply their observation skills to complete the questions attached to each.
  - **CALCULATION STATION** – Group members use their math skills to complete the station challenge. Skills may include graphing, analyzing data, using models, measurement, and calculating formulas or word problems.
  - **INVESTIGATION STATION** – Group members will work with one another to explore the concept through hands-on activities so they may practice specific inquiry process skills as they learn.
  - **COMMUNICATION STATION** – There are three different options for this station: interviews, video, group essay. Depending on the option you choose, group members will communicate what they know by answering questions in creative ways.
  - **CREATION STATION** – Group members will work together to solve a STEM (Science, Technology, Engineering, Math) challenge by creating models or designs that demonstrate their understanding of the science topic being taught.
  - **IMAGINATION STATION** – This station makes science concepts relevant for students by asking them to imagine scenarios that will bring about discussion and critical thinking.
6. **INQUIRY PROCESS SKILLS CHECKLIST** is provided with each set to show teachers and administrators the inquiry skills used by students in each activity. These skills include, but are not limited to, communicating, creating models, inferring, classifying, identifying variables, measuring, observing, predicting, gathering and organizing data, comparing and contrasting, interpreting data, and manipulating materials.

# SCIENCE STATIONS



**Eye Safety**

SCIENCE SKILLS AND LAB SAFETY

Materials:

- projector
- strong acid (HCl or acetic acid)
- eye dropper
- water

Procedure:

1. Draw an eye on the underside of the Post-It and display for class using the projector.
2. Cook over the egg and place the egg white only in the front dish.
3. Explain that the proteins in egg whites are similar to those found in the protective layer of the eye.
4. Tell them that someone was not being cautious and has splashed acid into their eye - add drops of acid to the egg white.
5. Ask students to make observations of what is happening to the egg white.
6. Try adding water to reverse the effects. Have students make observations.

What's Happening?

The protein in the egg white becomes cloudy when the acid is causing a denaturation of the protein. This can't be reversed chemically because acid is strong and is permanent that is chemical can cause severe damage to their eyes or skin if not used properly. Students must be made aware of the safety procedure associated with such as wearing goggles, gloves and aprons. Make sure they are aware of safety equipment - eye wash station, shower, fire blanket, etc.

Demonstration

Q: What happened to the "eye"?

A: The protective layer became cloudy and damaged the eye.

Q: What type of safety equipment must be worn when doing Lab?

A: goggles, apron, hot this gloves

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Discussion questions and teacher set-up included!

Teacher guide and answer key offered for every lab!

Easy-to-get materials!



Name \_\_\_\_\_ Date \_\_\_\_\_

**Measure with SI Units**

SCIENCE SKILLS AND LAB SAFETY

The standard system of measurement used by scientists around the world is known as the International System of Units, which is abbreviated as SI. SI units are easy to use because they are based on multiples of 10. Each unit is ten times larger than the next smallest unit and one-tenth the size of the next largest unit. The following table lists the prefixes used to name the most common SI units.

Common SI Prefixes		
Prefix	Symbol	Abbreviation
kilo-	k	1,000
hecto-	h	100
deca-	da	10
deci-	d	0.1
centi-	c	0.01
milli-	m	0.001

Materials:

- scattered seeds
- tape
- balance
- postage scale
- paper/cup/empty small milk carton
- fertilizer solution
- metric ruler
- 10-mL graduated cylinder
- colored pencils

Safety:

⚠

**Drip, Drop, Splat!**

How does the density of a liquid and drop height affect the height and shape of droplet splatters?

Materials:

- colored water (graduated cylinder A)
- colored syrup (graduated cylinder B)
- eye dropper
- paper
- metric ruler
- meter stick

Procedure:

1. Make a hypothesis of how density of a liquid will affect splatter size on your lab sheet.
2. Place the piece of paper down on the lab table in order to catch splatters.
3. Measure the heights listed in the data table using a meter stick. Place meter stick with end starting at zero on paper and move up stick when increasing height of drop.
4. Use the eye dropper to drop ONE drop of colored water and ONE drop of colored syrup. Make sure to drop on different places on paper.
5. Measure the size of the splatter in MILLIMETERS. Record in data table on answer sheet.
6. Repeat for each height.
7. Use the collected data to graph the splatter size versus drop height for each liquid.

Analyze and Conclude

1. Was your hypothesis correct? Explain.
2. What are two controls in your experiment that helped you collect the most accurate data possible?

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**USER-FRIENDLY PAGES:**  
Students easily recognize which answer sheet to use at each station by matching station icons located on each page!!

Name \_\_\_\_\_ Date \_\_\_\_\_

**Hypothesis**

Drop Height (cm)

Color	3	25	50	75	100
Colored Water					
Colored Syrup					

Height of Drop vs. Splatter Size

Number of Drops (mm)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
--	---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

Legend:

- Water
- Syrup

Analyze and Conclude:

1. \_\_\_\_\_
2. \_\_\_\_\_

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**TEACHERS SAVE TIME:**  
Laminate station pages and reuse for each class and for years to follow!  
Inquiry skills used are timeless!

# Instructional Videos

The Intro to Life Science Instructional Videos and Digital Assessments are designed to help teachers move instruction from the group learning space to the individual learning space. Not only does this give students independence in their learning, but it also allows more time for dynamic and interactive learning when teachers meet with students in a group setting.

This resource is perfect for:

- Flipped Classroom
- Absent students
- 1:1 Classrooms
- Sub Plans
- Hybrid Schedules
- Teachers who want more time to guide students as they apply concepts and engage creatively in the subject matter

Features of this resource include:

- Instructional videos which are six minutes or less to keep students focus
- Videos and assessments can be completed independently
- Auto grading and reporting in Google Forms
- Share link with students through educational platforms or email
- Quizzes are editable with 5 – 8 questions per quiz
- Information in video pairs with Nitty Gritty Science Interactive Notebooks

# Task Cards & Digital Task Cards

Task cards are a great tool for concept review that can be used in a variety of ways - pairs, small groups, team games, or individually. The reason they are so effective is there is only ONE task per card, allowing students to focus on that single task until they have successfully completed it. Answers sheet and answer key for teachers are included.

The digital, self-checking task cards are hosted at Boom Learning™ and are compatible with Google Classroom. These are perfect for displaying on your interactive whiteboard and leading class games or review sessions.

## Print Task Cards

The print task cards are arranged in a stack, showing various questions and answers. Each card has a blue border and a circular icon with a number and the text 'Electromagnetic Spectrum'. The cards include:

- Card 1 (DECIDE):** The \_\_\_\_\_ is equal to \_\_\_\_\_ of reflection.
- Card 2 (EXPLAIN):** \_\_\_\_\_ is when two or more waves overlap and combine to form a new wave.
- Card 3 (DECIDE):** \_\_\_\_\_ is when two or more waves overlap and combine to form a new wave.
- Card 4 (EXPLAIN):** How do refracted waves and diffracted waves differ?
- Card 5 (DECIDE):** What is the number of waves that pass a point in \_\_\_\_\_ called?
- Card 6 (EXPLAIN):** Cell phones use \_\_\_\_\_ waves to transmit information.
- Card 7 (DECIDE):** What causes electromagnetic waves?
- Card 8 (EXPLAIN):** What causes electromagnetic waves?
- Card 9 (DECIDE):** As frequency of a wave \_\_\_\_\_ wavelength decreases.
- Card 10 (EXPLAIN):** Waves travel through a \_\_\_\_\_ which can be a solid, a liquid, a gas, or a combination of these.

## Digital Task Cards

The digital task cards are displayed in a stack, showing interactive elements. Each card has a purple header with the title 'Waves and the Electromagnetic Spectrum'. The cards include:

- Card 1:** Features a satellite image of a storm and a question: 'To track a h...'. Below the question are two buttons labeled 'sound' and 'sona'.
- Card 2:** Features a blue sine wave and a question: 'Which images show the concept of refraction?'. Below the question are four images: a glass of water with a pencil, a pencil in a glass of water, a pencil in a glass of water, and a pencil in a glass of water.
- Card 3:** Features a question: 'Which images show the concept of refraction?'. Below the question are four images: a glass of water with a pencil, a pencil in a glass of water, a pencil in a glass of water, and a pencil in a glass of water.
- Card 4:** Features a question: 'Which images show the concept of refraction?'. Below the question are four images: a glass of water with a pencil, a pencil in a glass of water, a pencil in a glass of water, and a pencil in a glass of water.



# Study Guides: Includes **print** or **digital** options

Nitty Gritty Science Study Guides are directly aligned to the notes and assessments offered by Nitty Gritty Science and include a variety of review strategies which meet the needs of your learners for independent study and indirect instruction.

Each study guide provides a combination of strategies which may include:

- Graphic organizers
- Vocabulary building
- Compare and contrast
- Problem solving
- Concept mapping
- Interpreting data
- Critical thinking
- Theme connection
- Matching
- Fill-in-the-blank
- Short answer
- Real world application
- QR videos with accompanying questions

**WAVES & OPTICS**

**STUDY GUIDE**

Name: \_\_\_\_\_ Date: \_\_\_\_\_

**SECTION 1**

Directions: Describe three characteristics of waves in the graphic organizer and then answer the questions below.

**SECTION 2**

Directions: Complete the crossword puzzle with the correct word.


**SECTION 3**

Directions: Answer the questions below about the behavior of waves.

1. What is reflection? Use the pictures to help your explanation.

**SECTION 4**

Directions: Electromagnetic waves are



Radio Waves
Infrared Waves
Visible Light
Ultraviolet Waves
X-rays/Gamma Rays

**SECTION 5**

Directions: Fill in the blank with the best term below.

carrier wave	electromagnetic
television	GPS
cathode-ray tubes	sound


1. A radio converts \_\_\_\_\_ waves.
2. \_\_\_\_\_ produce the image.
3. A specific frequency is called a \_\_\_\_\_.
4. The audio sent by FM radio waves and video signals allows you to use this \_\_\_\_\_.
5. A system of satellites that allows users location is referred to as \_\_\_\_\_.
6. When an electrical signal creates a radio transmitted to and from a microwave use this device \_\_\_\_\_.

Directions: Explain how carrier waves transmit information.

AM FM

**SECTION 6**

Directions: Scan the QR code to watch the video about waves, define each of the terms, and then label each diagram correctly.

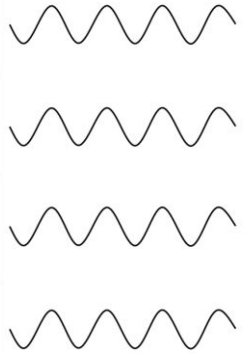


Frequency is \_\_\_\_\_

Period is \_\_\_\_\_

Wavelength is \_\_\_\_\_

Amplitude is \_\_\_\_\_



# Assessments:

Teachers can use a variety of assessments to evaluate student progress throughout the unit. The curriculum provides mini-quizzes for each Interactive Notebook chapter and an online assessments that goes with the instructional videos. The chapter test includes multiple choice, short answer, interpreting diagrams, and an essay.

Name \_\_\_\_\_ Date \_\_\_\_\_

**Quiz: Behavior of Waves**

Matching

\_\_\_\_ 1. Refraction a. when two or more waves combine to form a new wave

\_\_\_\_ 2. Diffraction b. wave strikes an object

\_\_\_\_ 3. Reflection c. bending of wave caused by change in medium

\_\_\_\_ 4. Interference d. angle of incidence of wave is equal to the angle of reflection

\_\_\_\_ 5. Law of Reflection e. object causes wave to bend toward it

6. Compare and contrast refraction and diffraction

\_\_\_\_\_

\_\_\_\_\_

-----

Name \_\_\_\_\_ Date \_\_\_\_\_

**Quiz: Behavior of Waves**

Matching

\_\_\_\_ 1. Refraction a. when two or more waves combine to form a new wave

\_\_\_\_ 2. Diffraction b. wave strikes an object

\_\_\_\_ 3. Reflection c. bending of wave caused by change in medium

\_\_\_\_ 4. Interference d. angle of incidence of wave is equal to the angle of reflection

\_\_\_\_ 5. Law of Reflection e. object causes wave to bend toward it

6. Compare and contrast refraction and diffraction

\_\_\_\_\_

\_\_\_\_\_

**CHAPTER TEST**

**EDITABLE CHAPTER TEST INCLUDES MULTIPLE CHOICE, FILL IN THE BLANK, INTERPRETING DIAGRAMS, & SHORT ANSWERS QUESTIONS**

**ANSWER KEY INCLUDED — IMAGES ARE BLURRED FOR COPYRIGHT REASONS**

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<https://www.teacherspayteachers.com/Store/Nitty-Gritty-Science-Jr>

