

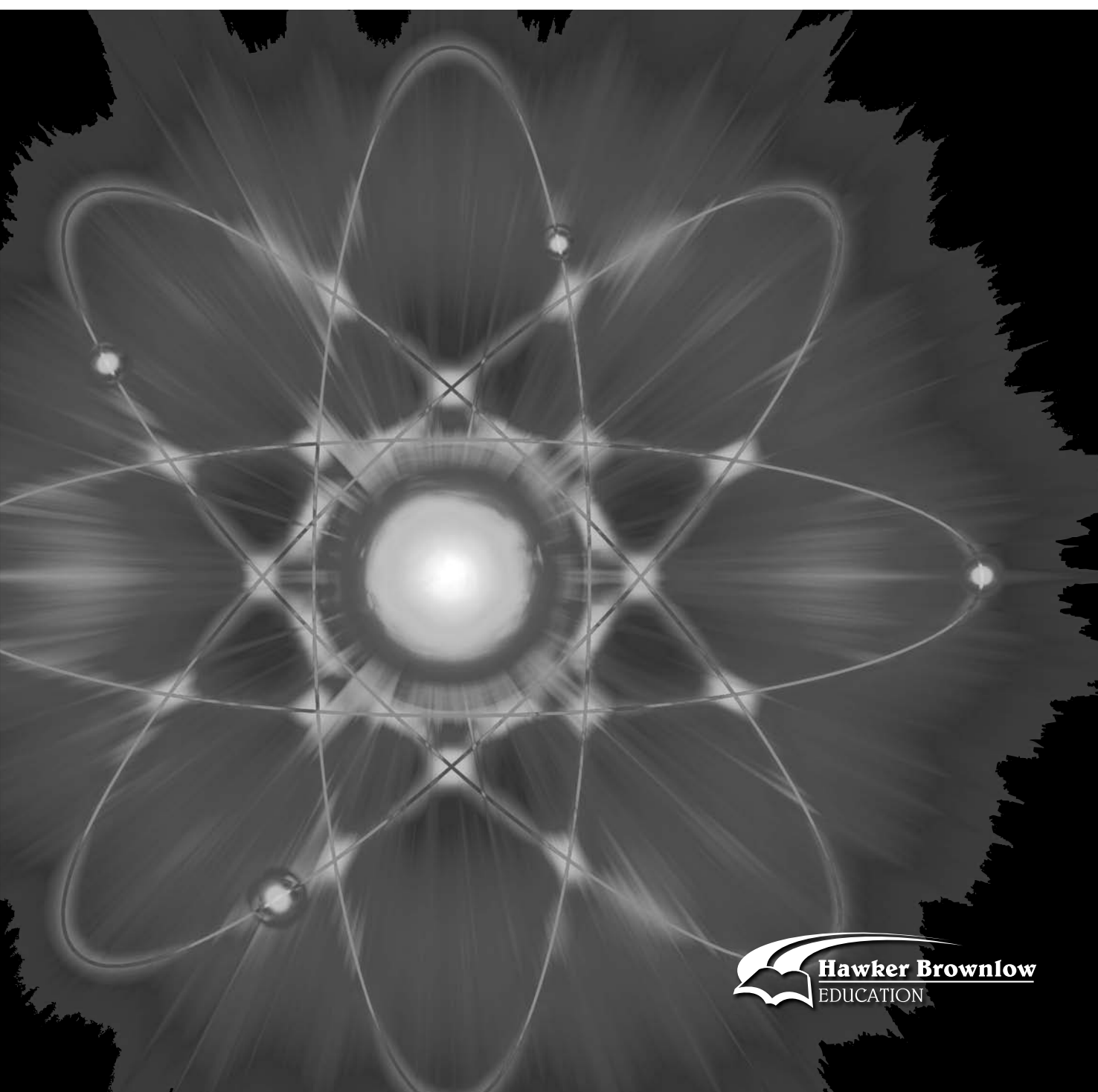
Teacher Guide

Science

Passwords

Physical
Science

Vocabulary for Science



Science Passwords: Vocabulary for Science is designed to build the vocabulary essential to understanding the key concepts students are studying in science. The topic areas and vocabulary words used in **Science Passwords: Vocabulary for Science** have been chosen based on the National Education Standards and the science standards developed by individual states. The topics and vocabulary words also align with the basal science textbooks of major publishers.

The **Science Passwords: Vocabulary for Science** program consists of eight books, Levels A to H, as well as individual **Earth Science**, **Life Science** and **Physical Science** books designed for use by older students.

Science Passwords: Vocabulary for Science is recommended for all students who need practice with the vocabulary that will help them succeed in science. These students may include English language learners as well as other striving learners. See pages 9–11 of this teacher guide for vocabulary teaching strategies that will help teachers meet the needs of all their students.

While the lessons in **Science Passwords: Vocabulary for Science** are grouped by topic area, each lesson may be taught independently. For a broad introduction to science, teachers may go through the book lesson by lesson. Alternatively, teachers may use only the lessons related to the science topic being taught in class. By providing an overview of year-level-appropriate science topics, **Science Passwords: Vocabulary for Science** may also be used to help students prepare and review for standardised tests in science.

The **Science Passwords: Vocabulary for Science** student book reading selections are available on an audio CD. The CD is a useful tool to use with English language learners or other students who would benefit from listening to the reading selections multiple times. Auditory learners will find listening to the selections on the CD especially helpful.

Science Passwords: Vocabulary for Science student books have been written and designed to provide students with a text that is “considerate”, or reader friendly. Three hallmarks of considerate text are: clear text structure, coherent writing and audience appropriateness. **Science Passwords** incorporates these characteristics of considerate text into every lesson.

Text Structure

The reading selections in **Science Passwords** feature text structures that exhibit clear organisational patterns. In descriptive text, information is given in a logical order of importance. For sequential text, events are presented in the order in which they occur. In cause-and-effect text, the relation between the actions or events is clearly stated.

Coherent Writing

The science concepts and ideas presented in **Science Passwords** are clearly stated. An introductory paragraph states the topic of the lesson. All the information in the reading selection connects to the topic. No extraneous material confuses readers. Headings and subheadings highlight the cohesion of each text segment. Transitional words and phrases signal the relation between actions or concepts.

Audience Appropriateness

Although the readability of **Science Passwords** reading selections is below year level, the concepts and material in the passages are year-level appropriate. Pre-reading activities activate students’

prior knowledge. Activities that follow the reading selection help teachers evaluate student understanding.

Look for these signs of considerate text in the **Science Passwords** student books.

- Short line length for increased readability
- Simple sentence structure
- Paragraphs with clear topic sentences and relevant supporting details
- Introductory subheadings
- Target vocabulary words boldfaced in text
- Definitions of target vocabulary words near the first use of the word
- Simple font
- Clean page layout
- Appropriate, not overwhelming, visuals
- Illustrations support content

Each student book for Earth Science, Life Science, and Physical Science has 15 lessons. Each lesson introduces and practises ten key vocabulary words related to a single science topic.

Features of the Lesson

Each lesson of the student book contains these features:

- Target Vocabulary
- Lesson Opener
- Reading Selection
- Graphics
- Activities A–D
- Word Root
- Write!

LESSON 9

wave longitudinal wave trough amplitude reflection
transverse wave crest wavelength frequency refraction

Suppose you throw a pebble into still water. Circles of waves move out from the pebble. What are these circles? Read this selection to see if you guessed correctly.

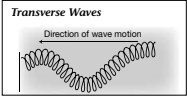
The Properties of Waves

A **wave** is a disturbance that transfers energy through matter, such as air or water, or through space. A wave moves in a regular, repeating pattern.

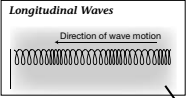
Some waves, such as water waves, move the matter they pass through up and down, at right angles to the direction the waves are moving. This type of wave is called a **transverse wave**.

Another type of wave is a **longitudinal wave**. When longitudinal waves move through matter, the matter moves backward and forward in the same direction that the wave is moving. Sound waves are longitudinal waves.

Transverse Waves



Longitudinal Waves



Measuring Wavelength

Transverse waves have repeating high points and low points, creating the wave pattern. Each high point, or top, of a wave is called a **crest**. The low point, or bottom, of a wave is a **trough**. The distance between the crest of one wave and the crest of the next wave is called the **wavelength**.

Target Vocabulary

The ten thematically related target vocabulary words are listed at the beginning of each lesson.

Lesson Opener

Tap students’ prior knowledge with this introductory paragraph.

Reading Selection

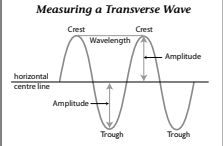
Reading selections use each target vocabulary word in context.

Graphics

Photos, illustrations, graphs, diagrams and charts expand and enhance meaning.

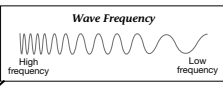
Amplitude and Frequency

The distance between the crest or trough and the horizontal line through the wave’s centre is the **amplitude** of the wave. Amplitude is a measure of how much the wave moves matter up and down from its resting position. It is the height or depth of the wave.



Measuring a Transverse Wave

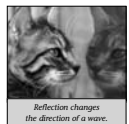
A third characteristic of waves is **frequency**. Frequency is the number of waves that pass a certain point in a given amount of time. Waves with a high frequency are close together; that is, the distance between crests is short. Low frequency means waves are far apart.



Wave Frequency

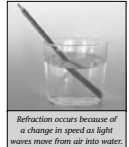
Behaviour of Waves

When a wave hits something, it may bounce off, just as a light wave does in a mirror. **Reflection** is the bouncing back of a wave that hits a surface. The speed of the wave does not change, but its direction does.



Refraction changes the direction of a wave.

When a wave moves from one type of matter to another, it goes slower or faster. The change in the wave’s speed causes refraction. **Refraction** is the bending of a wave. For example, light waves slow down and bend as they pass from air into water. The refraction of the light waves causes objects in the water to appear bent too.



Refraction occurs because of a change in speed as light waves move from air into water.

My Science Vocabulary

Go to page 96 to list other words you have learned about the properties of waves.

Progressively difficult activities follow each reading selection.

Activity A
Students match target vocabulary words with their meaning.

wave longitudinal wave trough amplitude reflection
 transverse wave crest wavelength frequency refraction

A. Match each word with its meaning. Write the letter of the correct meaning on the line in front of each word.

- _____ amplitude a. a wave that moves matter backward and forward, in the same direction as the wave
- _____ transverse wave b. the low point of a transverse wave
- _____ reflection c. a disturbance that transfers energy through

Activity B
Students choose the target vocabulary word that correctly completes a sentence.

wave longitudinal wave trough amplitude reflection
 transverse wave crest wavelength frequency refraction

B. Choose and write the two words that best complete each sentence.

- To determine the _____ of waves, you can count each _____ that passes a certain point in a given time.
- The top of a transverse wave is the _____, and the bottom is the _____.
- The bouncing of waves off a surface is _____, and the bending of waves is _____.
- A wave that moves the matter it passes through up and down is a _____, and one that moves the matter forward and back is a _____.
- The distance from one wave crest to the next is the _____, whereas the _____ is the height or depth of the wave.

WORD ROOT
The word **transverse** has the Latin root **versere**, which means "to turn" and the prefix **trans**, which means "across".

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Word Root
Students learn about the Greek or Latin root of a target vocabulary word.

Activity C
Students use target vocabulary words in cloze sentences.

wave longitudinal wave trough amplitude reflection
 transverse wave crest wavelength frequency refraction

C. Write the vocabulary word that best completes each pair of sentences.

- Sound waves are one kind of _____.
A _____ moves matter forward and backward.
- The top of a transverse wave is a _____.
The high point of a wave is called the _____.
- The measure of how much the wave moves matter up and down is _____.
The height or depth of a wave is _____.
- The bouncing back of a wave is _____.
When a light wave hits a mirror, _____ takes place.
- The distance from crest to crest is the _____.
High-frequency waves have a short _____.
- When waves change speed, _____ occurs.

Activity D
Students create sentences using the target vocabulary words.

wave longitudinal wave trough amplitude reflection
 transverse wave crest wavelength frequency refraction

D. Use each pair of words in a sentence.

- trough, amplitude

- wavelength, frequency

- crest, transverse wave

- wave, longitudinal wave

- reflection, refraction

Write!
Write your response to the prompt on a separate sheet of paper. Use as many vocabulary words as you can in your writing.
Suppose you are listening to music at a beach with waves you can see. Describe the kinds of waves you see and hear. What happens as you watch and listen?

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Write!
An independent writing activity strengthens and expands students' experience with the target vocabulary words.

Other Student Book Features

My Science Vocabulary
Students create a personal dictionary organised by topic area.

My Science Vocabulary

Lesson 1: Properties and Changes of Matter

Root Words
Students complete a chart about the Greek or Latin roots of target vocabulary words.

Root Words

The study of science in the Western world has always made use of the classical languages of Latin and Greek. These languages were linked with knowledge and learning. Scientists used them to name many things. Many words used in science today are based on those Latin and Greek "roots".

This chart shows some Latin and Greek roots, their meanings, and examples of science words that use the roots. Use the space provided to write other words with the same roots and to add new roots, meanings, and examples.

Latin or Greek Root	Meaning	Examples
conducere	to lead	conduction, _____, _____
generare	to bring forth	generator, _____, _____
lucere	to shine	translucent, _____, _____
_____	_____	_____, _____, _____
_____	_____	_____, _____, _____
_____	_____	_____, _____, _____

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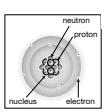
Glossary

acceleration (ak-seh-luh-RAY-shuhn) the change in an object's velocity (Lesson 6, page 34)

acid (AS-ihd) a substance that forms hydrogen ions when it is dissolved in water (Lesson 5, page 28)

action force (AK-shuhn fowrs) a force acting on an object (Lesson 6, page 34)

atom (AT-uhm) the smallest unit of an element that still has the properties of that element (Lesson 2, page 11)



atomic mass (uh-TOM-ihk mas) the mass of an atom, which is almost equal to the total number of protons and neutrons in the atom

Glossary
An illustrated glossary of the 150 target vocabulary words is found at the back of the book. Each entry includes a phonetic respelling and a simple definition, as well as the lesson number and page on which the word first appears.

Prefixes and Suffixes

Prefixes
A prefix is one or more letters or syllables added to the beginning of a word to change the meaning. For example, *hemi-* is a prefix that means "half". Think of the word *sphere*, which means "a circle". If you add the prefix *hemi-* to *sphere*, the new word *hemisphere* means "half a circle".

Prefix	Meaning	Examples
re-	backward	reflection, _____, _____
non-	not	nonmetal, _____, _____
ultra-	beyond	ultrasound, _____, _____
_____	_____	_____, _____, _____
_____	_____	_____, _____, _____

Suffixes
A suffix is one or more letters added to the end of a word. Some suffixes make a noun plural (-s added to *chemical* becomes *chemicals*) or change the tense of a verb (-ed added to *boil* becomes *boiled*). Other suffixes change how a word is used. For example, *-ise* is a suffix that means "make". If you add it to the noun *neutral*, the new word *neutralise* is a verb that means "to make neutral".

Suffix	Meaning	Examples
-al	pertaining to	chemical, _____, _____
-ity	state	density, _____, _____
-or	doer	indicator, _____, _____
_____	_____	_____, _____, _____
_____	_____	_____, _____, _____

© 2008 Hawker Brownlow Education CA10540 Prefixes and Suffixes 100

Prefixes and Suffixes
Students complete charts about the meaning of the prefixes and suffixes found in target vocabulary words.

The Teacher Guide for **Science Passwords: Vocabulary for Science** contains resources that may be used to introduce, support and extend students' science vocabulary studies. The Teacher Guide includes guided instruction for each student-book lesson.

Multi-Step Lesson Plan

Science Passwords is built upon the premise that students benefit most from the direct instruction of vocabulary. Each lesson as presented in the Teacher Guide follows a multi-step lesson plan.

1. Introduction of the target vocabulary
2. Activation of students' prior knowledge
3. Provision of the meaning of unknown words
4. Creation by students of visual representations using graphic organisers
5. Further experiences with the target vocabulary
6. Activities that help students retain the word and its meaning


Listening, Speaking, Reading and Writing

Science Passwords provides opportunities for students to practise the target vocabulary words while listening, speaking, reading and writing. These icons indicate opportunities for students to use the vocabulary words in different domains.

 Listening

 Speaking

 Reading

 Writing

Features of the Guided Teaching Lessons

Each lesson of the Teacher Guide contains these features:

- Target Vocabulary with definitions
- Vocabulary Strategy
- Lesson Summary
- Before Reading
- Word and Definition Cards
- Reproduced student book pages
- During Reading
- After Reading
- Annotated student book activity pages
- Extensions
- Ideas for introducing the Write! activity
- Sample answer for Write!
- Word Root extension

Target Vocabulary

The ten target vocabulary words are listed here with convenient, student-friendly definitions.

LESSON 9 The Properties of Waves

(Student book pages 52-57)

TARGET VOCABULARY

wave a disturbance that transfers energy
transverse wave a wave that moves up and down longitudinal wave a wave that moves back and forth
crest the top of a transverse wave
trough the bottom of a transverse wave
wavelength the distance from crest to crest
amplitude the depth or height of a wave
frequency the number of waves in a given time
reflection the bouncing back of a wave
refraction the bending of a wave

VOCABULARY STRATEGY: Multimeaning Words

Several of the target vocabulary words have more than one meaning. Remind students that context clues can help them determine which meaning of the word should be applied. Ask students what different meanings of the following target vocabulary words: *crest* (fall on a bird, design on a helmet, top of a hill) and *trough* (gutter, drinking bowl, low point).

Lesson Summary A transverse wave moves up and down, at right angles to the direction of movement of the energy. A longitudinal wave moves forward and back, in the same direction. A transverse wave has crests and troughs. The distance between crests on two succeeding waves is the wavelength. The amplitude is the depth of the wave, or its height from a midline. The frequency is how many waves pass a point in a given time. Waves may reflect back, or they reflect due to a change of speed when moving into a new medium.

BEFORE READING

Activate Prior Knowledge Bring in or have students bring in a Slinky. (If a Slinky is not available, you can model the transverse waves as described below with a piece of string or rope.) With the Slinky, demonstrate transverse waves that move the Slinky up and down, like ocean waves. Then demonstrate the movement of longitudinal waves by having someone hold one end steady while you push and pull the Slinky supported by a tabletop. Have students read the paragraph above the title of the lesson. Ask students which type of wave is represented by a pebble in water (transverse wave).

Introduce Target Vocabulary Tell students they are about to read a selection about the properties of waves. Write the target vocabulary words on the board. Model the pronunciation of each word and have student volunteers repeat the word. Discuss the meaning of each word and, if necessary, write the definition next to the word.

Present Graphic Organiser Provide each student with a copy of Vocabulary Graphic Organiser: Word Chart, Teacher Guide page 77. Have half the students write *transverse wave* and half write *longitudinal wave* in the Word box. Have students fill in as much of the chart as they can. As they read the lesson, students should continue to add information to the chart.

Word and Definition Cards for Lesson 9 are on pages 115 and 116 of the Teacher Guide.

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Vocabulary Strategy

A vocabulary strategy that is particularly appropriate for the lesson is highlighted here.

Word and Definition Cards

Teacher Guide page references make it easy to find and use the word and definition cards.

Lesson Summary

Use the summary for a quick introduction to the topic of the lesson.

Reproduced Student Book Pages

Student book lessons are reproduced for easy reference.

Before Reading

Questions and activities activate student's prior knowledge, build background and motivate students to read. Graphic organisers are provided to build students' understanding of the target vocabulary words.

LESSON 9 The Properties of Waves

(Student book pages 52-57)

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During Reading

Includes suggestions for presenting the reading selection and tips for explaining possibly difficult or confusing target vocabulary words.

After Reading

Provides guidance in using the graphic organisers to sum up the lesson and reminders to direct students to My Science Vocabulary and the Glossary.

Activities

The reproduced student book activity pages are annotated.

ACTIVITIES A-D Encourage students to complete as many of the activities as possible. Remind students that they may refer to the Glossary at the back of their book as they complete the activities. Students may work independently, in small groups, or as a class. When students are done, discuss the answers for each activity.

Extensions These extension ideas allow you to re-use or expand upon the activities. Share them with students who complete the activities before other students, or have students do them for additional practice with the target vocabulary words.

A Put the target vocabulary words in alphabetical order.

B Draw a picture or diagram for which one of the sentences would be an appropriate caption.

C Circle the simple subject (main noun) and underline the simple predicate (main verb) in each sentence. Look for four sentences that have more than one subject-verb pair.

D Rewrite each of your sentences so that the target vocabulary words appear in the opposite order.

WORD ROOT Have students explain how the meaning of the root *ver* relates to the meaning of *transverse wave* (it is a wave that is turned across or at an angle to the direction of movement). Then tell students that *longitudinal* means "moving lengthwise, or running lengthwise". Ask students for the common geography term that has the same root as *longitudinal* (*longitude*).

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Word Root

Provides additional information about the student book Word Root.

Write!

Each guided lesson provides hints about presenting the Write! activity as well as a sample answer.

Write! Distribute Writing Graphic Organiser: Idea Wheel, Teacher Guide page 81. Tell students to write *Waves* in the centre of the wheel. Then on the spokes of the wheel, they should write details about the kinds of waves they are seeing and the kinds they are hearing.

Sample Answer I am watching a water wave, which is a transverse wave. The amplitude of this wave is about 1.5 metres. I know this because it dips down that far from the normal surface of the water. The frequency of the water wave is about 40 waves per minute. The wavelength, from the crest to the crest of the next wave, is about 3 metres. When I step in the water, my legs look as if they bend because of refraction. Light changes speed in the water. I am also listening to sound, which is a longitudinal wave. The reflection of this sound off a rock wall makes it seem as if the sound is coming from the wall.

TAKE-HOME ACTIVITY Assign the Take-Home Activity to students for additional practice with the target vocabulary words. The reproducible Take-Home Activity for Lesson 9 is on page 92 of the Teacher Guide.

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Take-Home Activity

The Take-Home Activity for the lesson is reproduced with the answers provided.

Other Teacher Guide Features

- **Vocabulary Teaching Strategies**
Information and tips about how to employ vocabulary teaching strategies that have proven effective with struggling learners and English language learners begin on page 9.
- **Research Summary**
A summary of the research that forms the basis of *Science Passwords: Vocabulary for Science* is on pages 12–15.
- **Reproducibles**
Pages 76–128 of the Teacher Guide contain reproducibles for you to share with students.

Graphic Organisers

You may either photocopy the graphic organisers for students to use or use the sample graphic organiser as a model for students to create their own. The Before Reading section of each guided lesson suggests a particular vocabulary graphic organiser to use with the lesson. The Write! section of each guided lesson suggests a writing graphic organiser to use with the Write! activity.

- **Vocabulary Graphic Organisers**

Word Web Students write a topic in the central circle. Then they group related target vocabulary words in the outer circles. Beside each circle, they write a phrase that explains why they grouped the words together.

Word Chart Students use this graphic organiser to write a target vocabulary word, record its definition, list examples, use the word in a sentence, and draw a picture, a diagram, or write an equation about the word.

Four Square In this graphic organiser, students write a target vocabulary word in the centre rectangle. They illustrate the word, use the word in a sentence, write a definition of the word and list the part of the word (roots, prefixes and suffixes) in the surrounding squares.

Word Arrow Students use this graphic organiser to record target vocabulary words that follow a progression or sequence. They write the words that begin the sequence on the left of the arrow and add the target vocabulary words in the appropriate order, proceeding right to the arrow point.

- **Writing Graphic Organisers**

Main Idea and Details Chart This graphic organiser may be used with a variety of writing assignments. Students write a main idea in one box and the details that support it in another box.

Idea Wheel This variation of a web can be used with different types of writing. Students write a topic or main idea in the centre of the wheel. On the spokes of the wheel, they add details or ideas about the topic or main idea.

Narrative Map Use this graphic organiser when students are asked to write a narrative. They record the character(s) and setting(s) in the top boxes and the events of the narrative in the bottom box.

Sequence Chart A sequence chart provides students with a visual representation of the steps in a process. In this organiser, they record the steps, in order, in a series of boxes.

Word and Definition Cards

Word cards for each target vocabulary word as well as cards with the definitions for the words are on pages 99–128 of this Teacher Guide. You may either cut the cards out of the book or photocopy them, cut them apart, and then use them. For ideas on how to use the word and definition cards, see page 10 of this Teacher Guide.

Take-Home Activities

Each student book lesson has a take-home activity for additional practice and an opportunity for students to share what they have learned with family members.

LESSON 7

Simple Machines

(Student Book pages 40–45)

Lesson Summary Work is the moving of an object in the direction of the effort force against the resistance force. Simple machines lessen the effort force. The higher the mechanical advantage, the higher the machine's efficiency. An inclined plane, or ramp, requires less effort because the distance is longer. A wedge is an inclined plane that moves. A screw is an inclined plane on a cylinder. A lever has a bar moving on a fixed point. A wheel and axle multiplies the effort force. A pulley changes the direction of the effort force.

TARGET VOCABULARY

effort force the force used to move an object

resistance force the force that opposes the effort force

mechanical advantage how much a machine adds to the effort force

efficiency the ratio of work done to effort used

inclined plane a ramp

wedge an inclined plane that moves

screw an inclined plane wrapped around a cylinder

lever a bar that moves on a fixed point

wheel and axle a larger wheel with a smaller axle

pulley a rope threaded around a wheel

BEFORE READING

Activate Prior Knowledge

Ask students to define the word *work*. Note their definitions on the board. Then explain that in science, *work* has a specific meaning. For example, doing homework may seem like work to students, but only moving the pencil to write words is “work”. Holding a stack of books might seem like work, but in science, “work” is accomplished only when you move the books. Tell students this definition of work: Work is the movement of something over a distance in the direction of the force.

Introduce Target Vocabulary

Tell students they are about to read a selection about simple machines. Write the target vocabulary words on the board. Model the pronunciation of each word and have student volunteers repeat the word. Discuss the meaning of each word and, if necessary, write the definition next to the word.

Present Graphic Organiser

Provide each student with a copy of Vocabulary Graphic Organiser: Word Chart, Teacher Guide page 77. Assign each student a target vocabulary word. Have students fill in as much of the chart as they can. As they read the lesson, students should continue to add information to the chart.

Word and Definition Cards
for Lesson 7 are on pages 111 and 112
of the Teacher Guide.

VOCABULARY STRATEGY: Using Common Words

Tell students that sometimes to understand unknown words, such as science terms, they need to use their knowledge of common words. Point out the term *effort force*. From the word *effort*, they can guess that the term involves some kind of work. The word *force* means “strength or power”. So, it makes sense that *effort force* means “the power, or force, needed to move an object”. Have students use the same approach to explain *resistance force* (*the power that resists work*) and *mechanical advantage* (*the benefit from a machine*).

LESSON 7

effort force
resistance force
mechanical advantage

efficiency
inclined plane
wedge

screw
lever

wheel and axle
pulley

When you have work to do, the right tools make it easier. How do tools help you do work? What exactly is work? Read this selection to learn about simple machines.

Simple Machines

What Work Is

For work to be done, an object must move, and a force must act on the object to make it move. The amount of work is the force times the distance.

$$\text{work} = \text{force} \times \text{distance}$$

$$\text{work} = Fd$$

Work, in science, has a very specific meaning.

Simple Machines

A simple machine is a device with few parts that makes work easier. It changes the strength or direction of the force a person applies to an object, so less force is needed to move the object.

The force used to move an object is the **effort force**. The force that opposes the effort force is the **resistance force**.

A simple machine provides a mechanical advantage. The **mechanical advantage** is the number of times the machine multiplies the effort force. If a machine doubles the person's effort force, the machine has a mechanical advantage of 2.

The **efficiency** of a machine measures how much work the machine does compared to the effort, or energy, used. An efficient machine has a higher mechanical advantage.



When you use an inclined plane, you cover more distance but exert less force.

Inclined Planes

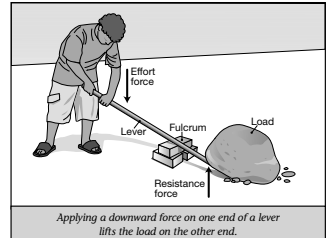
One simple machine is an **inclined plane**, or ramp. It takes less force to push an object up a ramp than to pick it straight up, even if the object has to be moved a longer distance.

A **wedge** is an inclined plane that moves. It is often used to cut or push objects apart. An axe is a wedge. The thin edge of the axe overcomes the resistance force of a log to cut through it.

A **screw** is an inclined plane wrapped in a spiral around a cylinder. Like a nail, a screw can hold objects together. A screw must be moved over a longer distance than a nail, but less force is needed.

Levers

A **lever** is a bar that moves around a fixed point, or fulcrum. A crowbar is a type of lever. The object to be lifted is the load. The downward force applied to the crowbar is the effort force. The upward force the crowbar uses to lift the load is the resistance force.



Wheel and Axle

A **wheel and axle** is a simple machine made of a wheel with a rod, or axle, in the centre. The effort force applied at the wheel is multiplied at the axle. The bigger the wheel is in comparison to the axle, the greater the mechanical advantage.

Pulleys

A **pulley** is a wheel with a rope or chain around it. A pulley helps with lifting heavy objects by changing the direction of the effort force from up to down.

My Science Vocabulary

Go to page 96 to list other words you have learned about simple machines.



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Simple Machines

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Simple Machines

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DURING READING

Read the selection aloud to students, stopping at the end of each paragraph or section. Review any words or concepts that students are having trouble with. Remind students that there is a glossary at the back of their book that contains all of the words that appear in boldfaced type in the lesson.

- Discuss each type of simple machine and have students find additional examples of simple machines being used in the classroom, in pictures or illustrations, or in photos or diagrams on the Internet. Some examples include the following: ramp for the disabled (inclined plane); axe, nail (wedge); car jack (screw); balance, crowbar, scissors, tongs, seesaw, wheelbarrow (lever); doorknob, screwdriver, steering wheel (wheel and axle); window blinds, flagpole pulley, crane (pulley).
- Have students refer to the diagram of the lever on page 41. As a volunteer reads the labels, have students point to that part of the lever.

Have students read the selection again on their own.

AFTER READING

Review Graphic Organisers

Answer any questions students have about the reading selection. Then have students complete or review their graphic organiser and share it with the class.

Summarise

Have students work together to come up with either a written or an oral summary of the lesson. Encourage students to use the target vocabulary words as the basis of their summary. Have students share their summary with the class.

My Science Vocabulary

Encourage students to turn to My Science Vocabulary on page 96 of the student book and use the space provided to add other words about simple machines.

effort force efficiency screw wheel and axle
 resistance force inclined plane lever pulley
 mechanical advantage wedge

A. Fill in the blanks with the correct vocabulary word.

1. how much work a machine does compared to the energy used
e f f i c i e n c y
2. an inclined plane that moves, such as an axe
w e d g e
3. a bar that moves around a fixed point
l e v e r
4. the force used to move an object
e f f o r t f o r c e
5. a ramp
i n c l i n e d p l a n e
6. a wheel with a rod attached to its centre
w h e e l a n d a x l e
7. the force that opposes the effort force
r e s i s t a n c e f o r c e
8. the number of times a machine multiplies the effort force
m e c h a n i c a l a d v a n t a g e
9. an inclined plane that wraps around a cylinder to form a spiral
s c r e w
10. a wheel with a rope or a chain around it
p u l l e y

effort force efficiency screw wheel and axle
 resistance force inclined plane lever pulley
 mechanical advantage wedge

B. Choose and write the two words that best complete each sentence.

1. A pulley has a wheel with a rope or chain around it, while a wheel and axle has a wheel with a rod through its centre.
 wheel and axle pulley inclined plane screw
2. The force used to move an object, or the effort force, is opposed by the resistance force.
 resistance force lever mechanical advantage effort force
3. A ramp is an inclined plane, and a crowbar is a lever.
 lever mechanical advantage inclined plane effort force
4. A machine works with more efficiency if it has a higher mechanical advantage.
 efficiency mechanical advantage wedge pulley
5. An inclined plane that moves is a wedge, and an inclined plane wrapped around a cylinder is a screw.
 wheel and axle screw wedge pulley

WORD ROOT
 The word **mechanical** has its roots in the Greek word **mekhane**, which means "machine."

ACTIVITIES A-D

Encourage students to complete as many of the activities as possible. Remind students that they may refer to the Glossary at the back of their book as they complete the activities. Students may work independently, in small groups, or as a class. When students are done, discuss the answers for each activity.

Extensions

These extension ideas allow you to re-use or expand upon the activities. Share them with students who complete the activities before other students, or have students do them for additional practice with the target vocabulary words.

- A** Put the target vocabulary words in alphabetical order.
- B** Choose a sentence and draw a picture or diagram to illustrate its meaning.

WORD ROOT

Have students list other English words that come from the Greek word *mekhane* (*machinery, machination, machinist, mechanic, mechanical, mechanise*). Encourage students to add these words to the root words chart on page 99 of their book.

- C** Rewrite each pair of sentences as a single sentence providing the same information.
- D** For each sentence you wrote, write a second sentence that provides details or examples related to your first sentence.

effort force efficiency screw wheel and axle
 resistance force inclined plane lever pulley
 mechanical advantage wedge

C. Write the vocabulary word that best completes each pair of sentences.

- The force used to move an object is the effort force.
The effort force is opposed by the resistance force.
- A ramp is an inclined plane.
An inclined plane lessens effort but increases distance.
- A wheel with a rope or chain around it makes a pulley.
The direction of force can be changed by a pulley.
- A simple machine has a mechanical advantage because it multiplies the effort force.
A machine that doubles a person's effort force has a mechanical advantage of 2.
- The force that opposes the effort force is the resistance force.
The force a lever uses to lift a load is the resistance force.
- An inclined plane that moves is a wedge.
An axe is an example of a wedge.
- A bar moving on a fixed point is a lever.
A crowbar is one example of a lever.
- The measure of how much work a machine does compared to the effort used is efficiency.
A high mechanical advantage yields high efficiency.
- An inclined plane around a cylinder is a screw.
A screw spreads the effort along the spiral's length.
- A wheel and rod make up a wheel and axle.
A doorknob is an example of a wheel and axle.



effort force efficiency screw wheel and axle
 resistance force inclined plane lever pulley
 mechanical advantage wedge

D. Use each word in a sentence that shows you understand the meaning of the word.

- wheel and axle A Ferris wheel is a giant wheel and axle.
- efficiency Is the efficiency of a power lawn mower greater than that of a push mower?
- effort force The force used to move an object is the effort force.
- wedge A wedge is an inclined plane that moves, such as an axe.
- pulley A pulley is used to raise the flag on a flagpole.
- mechanical advantage All simple machines provide a mechanical advantage.
- screw A screw makes use of a spiral inclined plane to spread the effort over a longer distance.
- resistance force The force a crowbar uses pushes up on the load.
- efficiency The efficiency of a machine is a measure of how much work it can do for the effort put in.
- lever A bottle opener is one type of lever.



Write!
 Write your response to the prompt on a separate sheet of paper. Use as many vocabulary words as you can in your writing.

Imagine that your job is to evaluate simple machines. Write a description of some simple machines that you would recommend and how you might rate them.

Write!

Distribute Writing Graphic Organiser: Idea Wheel, Teacher Guide page 81. Tell students to write *Simple Machines* in the centre of the wheel. Then on the spokes of the wheel, they should write details about each type of simple machine they will recommend and how they will evaluate these machines.

Sample Answer

I will recommend this inclined plane because the effort to push a box up the long ramp is less than lifting it. Over here, I have a pulley to lift heavy weights upward by pulling downward on the long rope. This axe is a wedge that cuts well. Over here, is a shovel, which is a lever. This screw requires little effort to go into wood. It has an inclined plane that wraps around its cylinder.

To evaluate the machines, I will find each machine's mechanical advantage. I am looking for the machines with the greatest efficiency.

TAKE-HOME ACTIVITY

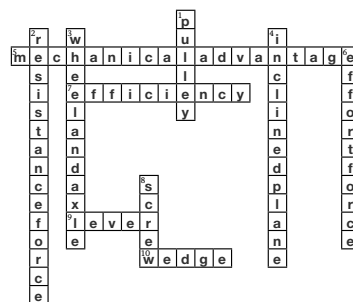
Assign the Take-Home Activity to students for additional practice with the target vocabulary words. The reproducible Take-Home Activity for Lesson 7 is on page 90 of the Teacher Guide.

TAKE HOME 7

effort force efficiency screw wheel and axle
 resistance force inclined plane lever pulley
 mechanical advantage wedge

Use vocabulary words to complete the puzzle.

Simple Machines



ACROSS

- the number of times a machine multiplies the effort force
- a measure of how much work a machine does compared to the effort used
- a simple machine with a bar that moves around a fixed point
- an inclined plane that moves

DOWN

- a wheel with a rope or chain around it that changes the direction of the force
- the force that opposes the effort force
- a simple machine made of a wheel with a rod in the centre
- a ramp
- the force used to move an object
- an inclined plane wrapped in a spiral around a cylinder



Tell someone in your family what you have learned about simple machines.