

TSUNAMIS

Killer Waves

Tsunami! came the cry in the distance.

² At first, 18-year-old Mieko Browne thought it was an April Fool's joke. Then she looked up and saw that it wasn't. A massive wall of water was headed straight for her house in Hilo, Hawaii. Mieko's mother saw it, too. She pushed Mieko inside the house, slamming the door shut just as the wave ripped the house off its foundation.

³ A series of waves then sucked the house in and out of Hilo Bay. As the two women looked helplessly out a window, they saw dead bodies floating by, surrounded by dead fish and other debris. They saw one boy clinging desperately to a piece of lumber. On the third wild rush back to the shore, Mieko and her mother got lucky. Their house crashed into the side of a factory that hadn't been uprooted. Somehow, Mieko and her mother managed to scramble out of the house and into the safety of the factory.

⁴ Many other Hawaiians were not so lucky. It was April 1, 1946, and the city of Hilo had just been hit by a series of giant



This illustration shows a tsunami engulfing buildings. Note the erupting volcano in the background.

waves called a *tsunami*. (A tsunami may be just one wave. More often, however, it is a series of waves.) The tsunami in 1946 was the most deadly in Hawaiian history. The waves killed 170 people and injured more than 160 others. The people had no warning at all. It is said that if you can see a tsunami, it is too late to get out of its way. A tsunami moves that fast. One moment the people of Hilo were enjoying a fine day; the next moment they were face to face with a deadly tower of water.

5 What causes these monster waves? First, it is important to know what doesn't cause them. Tsunamis have nothing to do with tides. They can hit at high tide or low tide or at any time in between. Tides are caused by the pull of gravity between the earth and the moon. So it is wrong to refer to a tsunami as a tidal wave. Also, ordinary waves are created when wind passes over the water. Wind, no matter how wild, cannot create a tsunami. Even a hurricane cannot produce a tsunami.

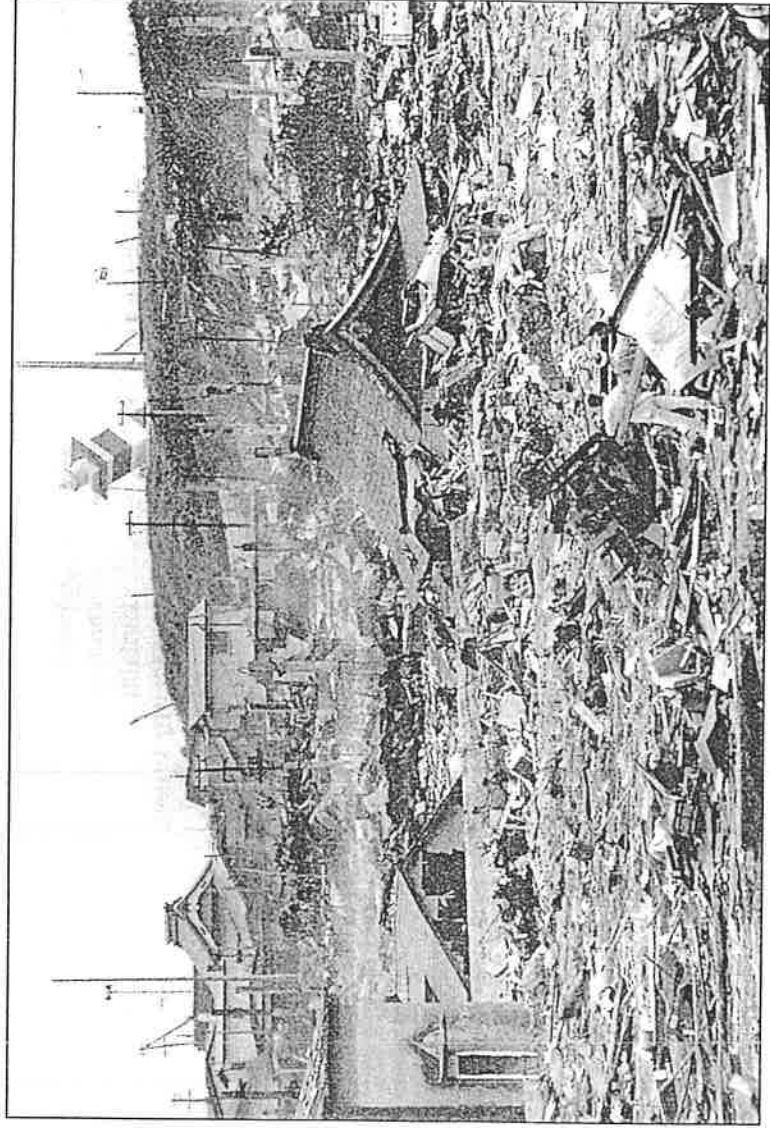
6 Most tsunamis are caused by unseen forces on the floor of the ocean. Often the cause is a large earthquake under the sea. Tsunamis can also be started by underwater volcanoes. They can even be caused by volcanoes near the sea. The key factor is a sudden rise or drop in the ocean floor. That triggers the water above the floor to start moving. And it moves

extremely fast. A tsunami travels about 500 miles an hour—about the speed of a jet plane. The tsunami that struck Hilo was started by an earthquake off the coast of Alaska more than 2,200 miles away. It only took the killer waves about five hours to reach Hilo.

7 On the open ocean, a sailor wouldn't even notice a tsunami. It might be 100

miles long but only about two or three feet high. A wave that size can't generate enough power to spill a cup of coffee on board a ship. But when a tsunami nears land, all its vast energy becomes concentrated and the wave can rise up 100 feet or more.

8 As a tsunami approaches land, it sucks the water out of a harbor or beach in an



An earthquake, followed by a tsunami, caused massive destruction on Okushiri Island in 1993.

A Finding the Main Idea

The statement below expresses the main idea of the article. One statement is too general, or too broad. The other statement explains only part of the article; it is too narrow. Label the statements using the following key:

M—Main Idea

B—Too Broad

N—Too Narrow

1. A tsunami is a series of fast-moving, deadly waves that are most often triggered by underwater earthquakes or volcanoes.
2. The tsunami that struck Hilo, Hawaii, in 1946 killed 170 people.
3. Most tsunamis occur in the Pacific Ocean.

_____ Score 15 points for a correct M answer.

_____ Score 5 points for each correct B or N answer.

_____ **Total Score:** Finding the Main Idea

B Recalling Facts

How well do you remember the facts in the article? Put an X in the box next to the answer that correctly completes each statement about the article.

1. Most tsunamis are caused by
☐ a. movements on the ocean floor.
☐ b. tidal changes.
☐ c. very strong winds or hurricanes.
2. A tsunami travels about
☐ a. 200 miles per hour.
☐ b. 500 miles per hour.
☐ c. 100 miles per hour.
3. As a tsunami approaches land, it
☐ a. sucks the water out of a harbor in an instant.
☐ b. loses power.
☐ c. triggers an earthquake.
4. The first recorded case of a tsunami occurred in
☐ a. 1883.
☐ b. 1896.
☐ c. A.D. 365.
5. The biggest problem with forecasting tsunamis is
☐ a. predicting when they will strike.
☐ b. predicting where they will strike.
☐ c. determining how large the waves will be.

Score 5 points for each correct answer.

_____ **Total Score:** Recalling Facts

instant. (*Tsunami* comes from the Japanese words *tsu*, meaning "harbor," and *nami*, meaning "wave.") The sucking action leaves fish flopping on the sand and probably wondering where all the water went. But then, the water curls up like some mythical monster and comes roaring back to the shore.

9 Most tsunamis occur in the Pacific Ocean. That's because that region has a large number of earthquakes and volcanoes. Tsunamis have also struck in the Indian Ocean and in the eastern Atlantic. They can even hit smaller bodies of water, such as the Black Sea.

10 Tsunamis have cut a deadly path through human history. The first recorded case occurred in A.D. 365 on July 21. The tsunami was triggered by a huge earthquake on the ocean floor. The terrible waves struck Alexandria, Egypt, and killed thousands of people.

11 The worst tsunami ever occurred on an island in Indonesia. It was caused by a volcano called Krakatoa. In late August 1883, Krakatoa erupted. Soon after, a 100-foot wave hit the islands of Sumatra and Java. The crushing water destroyed thousands of homes and boats. The wave wiped nearly 300 towns off the map. Worse, it took the lives of more than 36,000 people.

12 On June 15, 1896, another tsunami struck Japan. This one was caused by an underwater earthquake. It took just an hour for the wave to reach Sanriku Beach. There, thousands of people had gathered to celebrate a religious festival. They had

no chance to escape. A 75-foot wave caught them completely by surprise. More than 26,000 people drowned.

13 Imagine the shock of local fishermen, who had been fishing a couple of miles offshore when the tsunami struck. The wave had rolled harmlessly under their boats. The men hadn't felt a thing. But when they returned to the beach, they saw the vast wreckage and piles of dead bodies on the beach. To them, it must have seemed as if the world had come to an end.

14 Today, scientists are learning how to predict tsunamis. Since the Hilo disaster, early warning systems have been developed. Large earthquakes and volcanoes are closely monitored. Scientists can now plot how long it will take for a tsunami to reach vulnerable places.

15 Still, the system is not perfect. Tsunamis still kill. In 1992, one struck Indonesia, taking more than 1,000 lives. In 1993, a tsunami in Japan killed 330 people. A tsunami in the Philippines took the lives of 62 people in 1994.

16 The biggest problem with forecasting tsunamis is predicting whether the waves will be killers or harmless ripples. The power of a tsunami depends on many factors. One is the contour of the land. The shape of the land can funnel a wave into a small area with disastrous results. Or it can spread the wave out over a wide area, greatly reducing the damage.

17 Differences in land shape make it nearly impossible to provide precise warnings. In October 1995, there was a

strong earthquake off the coast of Japan. A full-scale tsunami warning was issued for all of southern Japan. Thousands of people fled from the shore. Three hours later, the warning was lifted. The biggest wave to hit the mainland had been 4½ inches high. One small island reported a six-foot wave. And that was it!

18 False alarms are dangerous. Katsuyuki Abe, a top tsunami expert, explains why. He says that the current warnings are "too rough, the area too wide. There is a fear that [such false alarms] will create a boy-who-cried-wolf effect, that people will stop listening."

19 They better not, though. Tsunami warnings should never be taken lightly. Just ask anyone who has seen a tsunami up close. Mieko Browne won't take any more chances. When she got married, she told her husband: "We're not living at the beach. We're going to live in the mountains!"

If you have been timed while reading this article, enter your reading time below. Then turn to the Words-per-Minute Table on page 133 and look up your reading speed (words per minute). Then enter your reading speed on the Reading Speed graph on page 134.

Reading Time: Lesson 11

Minutes : Seconds

Author's Approach

Put an X in the box next to the correct answer.

1. The author uses the first sentence of the article to
 - ☐ a. inform the reader about tsunamis.
 - ☐ b. describe the qualities of a tsunami.
 - ☐ c. encourage the reader to find out about tsunamis.
2. The author's purpose in writing "Tsunamis: Killer Waves" is to
 - ☐ a. express an opinion about tsunami warning systems.
 - ☐ b. inform the reader about tsunamis.
 - ☐ c. describe the devastation caused by tsunamis.
3. What does the author imply by saying "There is a fear that [such false alarms] will create a boy-who-cried wolf effect"?
 - ☐ a. Too many false alarms may cause people to panic.
 - ☐ b. Too many false alarms may prevent people from taking any warnings seriously.
 - ☐ c. Some people fear that the false alarms are the result of childish pranks.
4. How is the author's purpose for writing the article expressed in paragraph 5?
 - ☐ a. The author describes the effect of the wind on tsunamis.
 - ☐ b. The author emphasizes the similarities between tidal waves and tsunamis.
 - ☐ c. The author explains the difference between tidal waves and tsunamis.

Scientists can now plot how long it will take for a tsunami to reach vulnerable places.

- ☐ a. unprotected
- ☐ b. faraway
- ☐ c. well defended

Score 3 points for each correct C answer.

Score 2 points for each correct O answer.

Total Score: Using Words Precisely

Enter the four total scores in the spaces below, and add them together to find your Reading Comprehension Score. Then record your score on the graph on page 135.

Lesson 11

Score	Question Type
_____	Finding the Main Idea
_____	Recalling Facts
_____	Making Inferences
_____	Using Words Precisely
_____	Reading Comprehension Score

_____ Number of correct answers

Record your personal assessment of your work on the Critical Thinking Chart on page 136.

C Making Inferences

When you combine your own experience and information from a text to draw a conclusion that is not directly stated in that text, you are making an inference. Below are five statements that may or may not be inferences based on information in the article. Label the statements using the following key:

C—Correct Inference

F—Faulty Inference

1. A tsunami moves so quickly that people in its path cannot escape from it. _____
2. Early warning systems can help protect people from tsunamis. _____
3. False alarms increase people's awareness of tsunamis. _____
4. People on a boat in the middle of the ocean would not be aware of an approaching tsunami. _____
5. When a volcano or earthquake is detected in an area, its residents should be on the alert for a tsunami warning. _____

Score 5 points for each correct answer.

_____ Total Score: Making Inferences

D Using Words Precisely

Each numbered sentence below contains an underlined word or phrase from the article. Following the sentence are three definitions. One definition is closest to the meaning of the underlined word. One definition is opposite or nearly opposite. Label those two definitions using the following key; do not label the remaining definition.

C—Closest

O—Opposite or Nearly Opposite

1. Large earthquakes and volcanoes are closely monitored.
 _____ a. disregarded
 _____ b. felt
 _____ c. observed closely
2. But when a tsunami nears land, all its vast energy becomes concentrated and the wave can rise up 100 feet or more.
 _____ a. limited
 _____ b. immense
 _____ c. recycled
3. But then, the water curls up like some mythical monster and comes roaring back to the shore.
 _____ a. historical
 _____ b. imaginary
 _____ c. hideous
4. Differences in land shape make it nearly impossible to provide precise warnings.
 _____ a. annual
 _____ b. exact
 _____ c. inaccurate

Personal Response

I know how Mieke Browne feels because

Self-Assessment

I'm proud of how I answered question _____ in section _____ because

CRITICAL THINKING

4. Think about cause-effect relationships in the article. Fill in the blanks in the cause-effect chart, drawing from the letters below.

Cause	Effect
The ocean floor rises or drops sharply.	_____
_____	A 100-foot wave hit Sumatra and Java.
_____	Thousands fled the Japanese shore in 1995.
a. Krakatoa erupted.	
b. A full-scale tsunami warning was issued for all of southern Japan.	
c. The water above the floor starts moving.	

5. Of the following theme categories, which would this story fit into?

- ☐ a. No man is an island.
☐ b. Life is unpredictable.
☐ c. People are powerless before the force of nature.

_____ Number of correct answers

Record your personal assessment of your work on the Critical Thinking Chart on page 136.

Summarizing and Paraphrasing

Follow the directions provided for question 1. Put an X in the box next to the correct answer for question 2.

1. Look for the important ideas and events in paragraphs 12 and 13. Summarize those paragraphs in one or two sentences.
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-
-

2. Choose the sentence that correctly restates the following sentence from the article:

"The shape of the land can funnel a wave into a small area with disastrous results."

- ☐ a. The force of a tsunami wave concentrated in a small, narrow area can have devastating results.
- ☐ b. A tsunami wave can destroy the shape of the land in a small area.
- ☐ c. Small areas are more likely to be struck by tsunamis.

CRITICAL THINKING

_____ Number of correct answers

Record your personal assessment of your work on the Critical Thinking Chart on page 136.

Critical Thinking

Put an X in the box next to the correct answer for questions 1, 2, and 5. Follow the directions provided for the other questions.

1. Which of the following statements from the article is an opinion rather than a fact?
- ☐ a. "Wind, no matter how wild, cannot create a tsunami."
- ☐ b. "Tsunami warnings should never be taken lightly."
- ☐ c. "Tsunamis have cut a deadly path through human history."
2. From what the article told about tsunamis, you can predict that
- ☐ a. scientists will stop issuing tsunami warnings in Japan.
- ☐ b. scientists will be able to prevent tsunamis from occurring.
- ☐ c. tsunamis will continue to strike coastal areas of the Pacific Ocean.
3. Choose from the letters below to correctly complete the following statement. Write the letters on the lines.
- In the article, _____ and _____ are different.
- a. tidal waves
- b. a series of waves triggered by an underwater volcano
- c. tsunamis