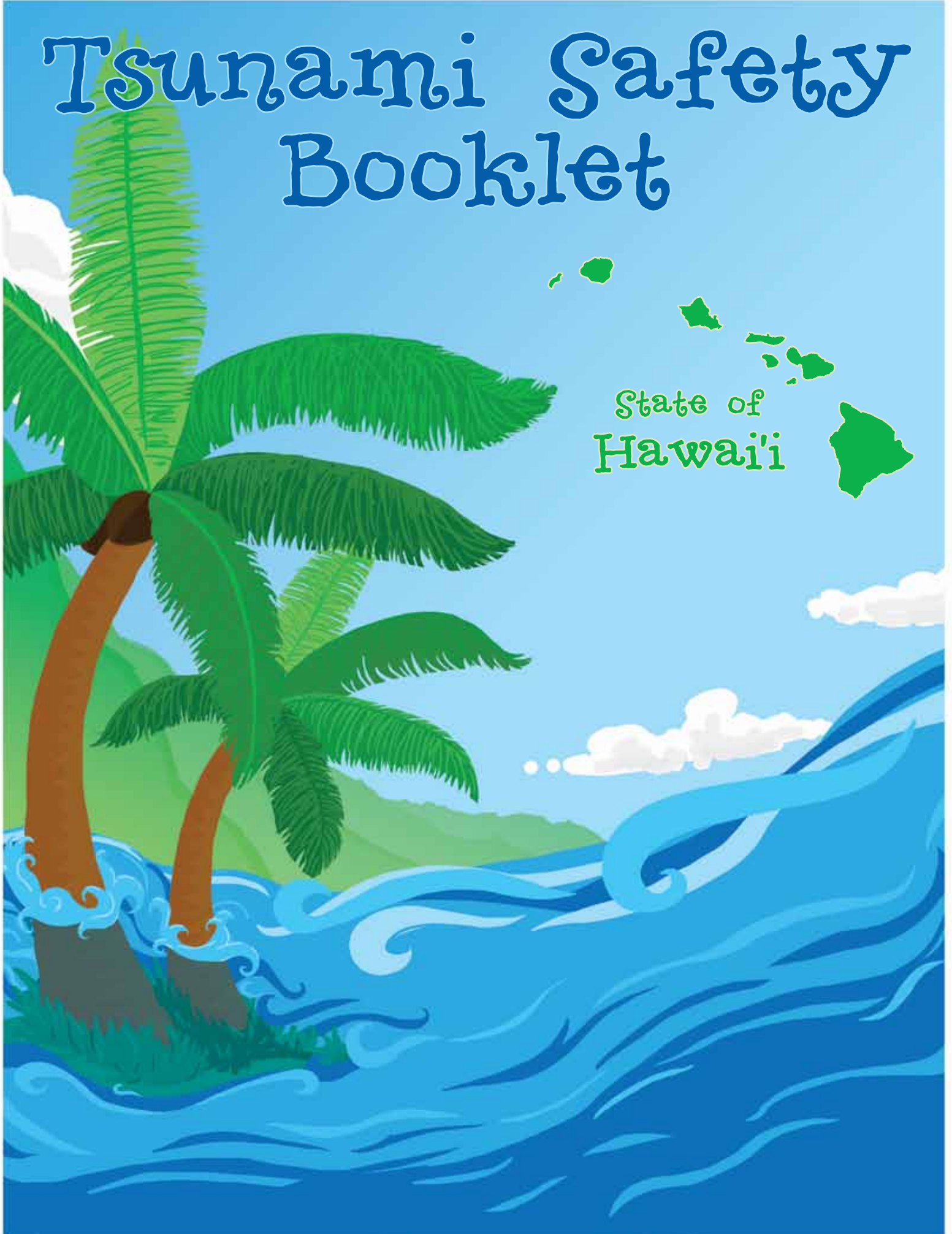


Tsunami Safety Booklet



State of
Hawai'i



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Tsunamis in Hawai'i

Hawaiian myths and legends speak of great sea floods and the "rising of the sea to the hills." These stories suggest that tsunamis have impacted Hawaiian coastal communities in the past, just as they do today. It is important to learn about what has happened in the past so that we can be prepared for the future.

**'Iliki ke kai i ka 'ope'ope la, lilo;
i lilo no he hawawā.**

*The sea snatches the bundle, it is gone;
it goes when one is not watchful.*

Interpretation

A person who fails to watch out often loses.
Never turn your back on the sea.

Look for the *No Ka 'Ohana* activities throughout the booklet. *No Ka 'Ohana* means 'for the 'ohana' so these challenges should be done at home.



BE A Tsunami SUPERHERO!

Tsunami Superheroes are kids just like you who know all about tsunami safety and have pledged to help others prepare for the next tsunami event.

Build your Superhero powers by completing the Tsunami Superhero Challenge after the activities throughout this booklet. When you have finished them all, you will be a Tsunami Superhero!

Why Learn About Tsunamis?

A **tsunami** is one of nature's most dangerous natural **hazards**. Tsunamis have killed many people in Hawai'i and caused millions of dollars in damage.¹ Tsunamis have also caused death and destruction in other parts of the world. On average a **dangerous** tsunami occurs somewhere on earth nearly every year.

There is no tsunami season and a tsunami can strike at any time of day or night, in good weather or bad. When a tsunami reaches **shore**, a series of **waves** can **flood** inland over a period of several hours.

Hawai'i is vulnerable to tsunamis generated far away along the Pacific Ocean rim and also to

tsunamis generated right here in Hawai'i. A tsunami from far away (*distant tsunami*) will take many hours to reach our shores, but a tsunami generated here in Hawai'i (*locally generated tsunami*) can reach our shores in minutes!

Studying our history of past tsunamis helps us to know which areas are safe from tsunami waves and which areas are dangerous and should be **evacuated**. Tsunamis can be deadly, but if you understand them and learn what to do when the next tsunami strikes, you will have a better chance of keeping yourself and your 'ohana **safe**.

¹http://www.pdc.org/iweb/tsunami_history.jsp

The words have been scrambled by the tsunami waves. Use the words in bold from above to help you unscramble.

erhso

fase

lodof

evaws

iawiaH

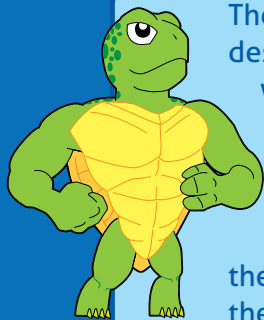
vecatudae

radahsz

mistanu

gourdesna

Superhero Challenge!



There are two Hawaiian words used when describing a tsunami. These words are **kai e'e**, which refers to tsunamis in general, and **kai mimiki**, which refers to the withdrawal of water that can occur before **kai e'e** waves arrive. Practice saying these words and learn their meanings. Teach these words to your 'ohana and share with them two reasons from the text above why it is important to learn about tsunamis.

No Ka 'Ohana

Talk with your 'ohana and kupuna about the **impact** that past tsunamis have had on coastal communities in your area and how they were experienced by the people who lived through them.

evacuate: to remove persons from an area for reasons of safety

Tsunami Scientist

A tsunami is made up of a series of waves which are caused by violent movements of the sea floor. The largest tsunamis are caused by underwater earthquakes which move huge amounts of water, but they can also be caused by landslides and volcanic eruptions.

Most tsunamis occur in the Pacific because large earthquakes and geologic activity are frequent there. Tsunamis can travel across the ocean at over 500 miles per hour – which is as fast as a jet airplane!

Hawai'i is geologically active, so tsunamis can also be generated right here in the islands. Because tsunamis can travel so fast, a locally generated tsunami can reach our shores within minutes of a large earthquake.

Pacific Ocean Tsunami Travel Time Map



This is a map of the Pacific Ocean showing approximately how long it takes a tsunami to travel from one location to another with each ring representing one hour of travel time.

For example, a distant tsunami from Japan would take approximately 8-10 hours to reach Hawai'i.

Start at Hawai'i and count outwards to discover how long it will take for:

A tsunami coming from Alaska to hit Hawai'i? _____

A tsunami coming from Chile to Hawai'i? _____

Using this map you can also calculate how long it would take for a tsunami from somewhere in the Pacific Rim to reach a distant shore by counting the hours from the source of the tsunami. How long would it take:

A tsunami coming from Chile to strike Japan? _____



Superhero Challenge!

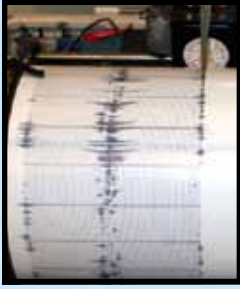
In small groups, fill in the blanks below and then practice being a tsunami scientist by reading the following message aloud to your group. You can find all of the information to fill in the blanks in the text above.

"A large _____-quake has generated a tsunami from off the coast of Japan. Tsunamis are made up of a series of waves that travel at over _____ miles per hour. The tsunami is expected to strike Alaska in approximately _____ hours and the islands of Hawai'i in approximately 8-10 hours. All low-lying coastal areas in the State of Hawai'i may be asked to evacuate to higher ground. Please listen for sirens and radio and television broadcasts by Civil Defense Agencies and the Department of Emergency Management."

I ka nānā no a'ike.
By observing one learns.

Tsunami Warning System

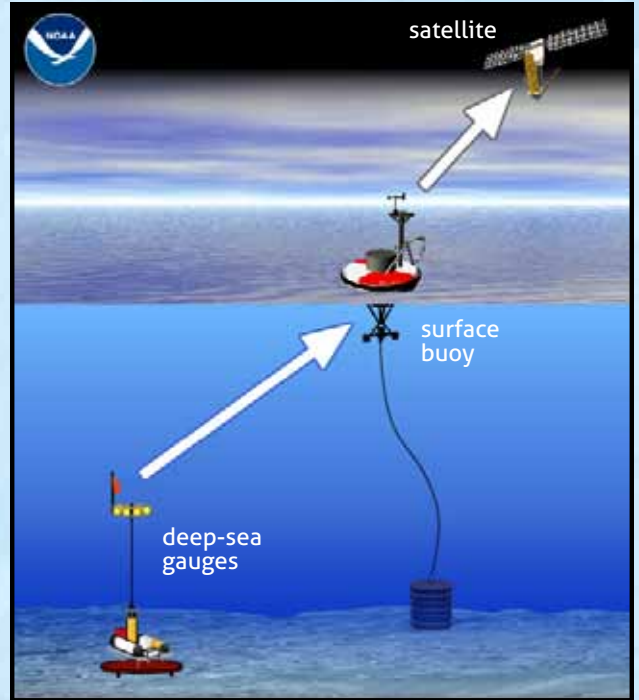
Scientists are always on the alert for the next tsunami event. When an earthquake occurs, instruments called



seismographs record the seismic (earthquake) waves that travel through the earth. Scientists at the Pacific Tsunami Warning Center (and other tsunami warning centers) **monitor** seismographs around the world to see if the earthquake is large enough to possibly cause a tsunami.

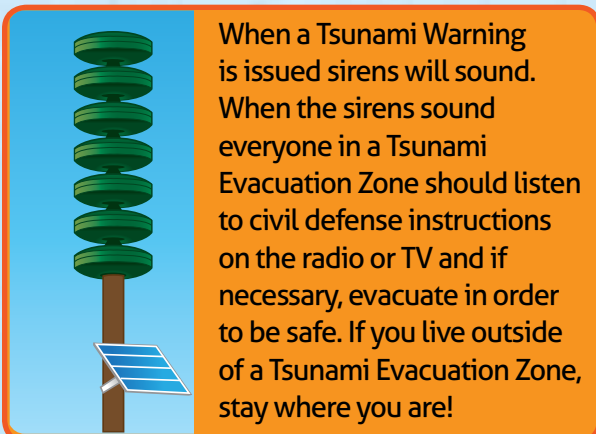
Scientists then **monitor** special deep-sea gauges that record the passage of actual tsunami waves in the deep ocean. These instruments are called DART buoys, which stands for "Deep-ocean Assessment and Reporting of Tsunamis".

The deep-sea gauges send information from a surface buoy through satellites to the Warning Centers, which then decide if a tsunami has been **generated** and is traveling through the ocean.



The speed tsunami waves travel is controlled by the depth of the ocean. Because scientists know the depth of the ocean they can predict how fast the waves will travel and therefore how long it will take them to reach us from.

When scientists at the Warning Centers are certain that a tsunami is approaching, they will issue a Tsunami Warning.



When a Tsunami Warning is issued sirens will sound. When the sirens sound everyone in a Tsunami Evacuation Zone should listen to civil defense instructions on the radio or TV and if necessary, evacuate in order to be safe. If you live outside of a Tsunami Evacuation Zone, stay where you are!

Sirens are also used for hurricane warnings and other major evacuations.

Vocabulary Match

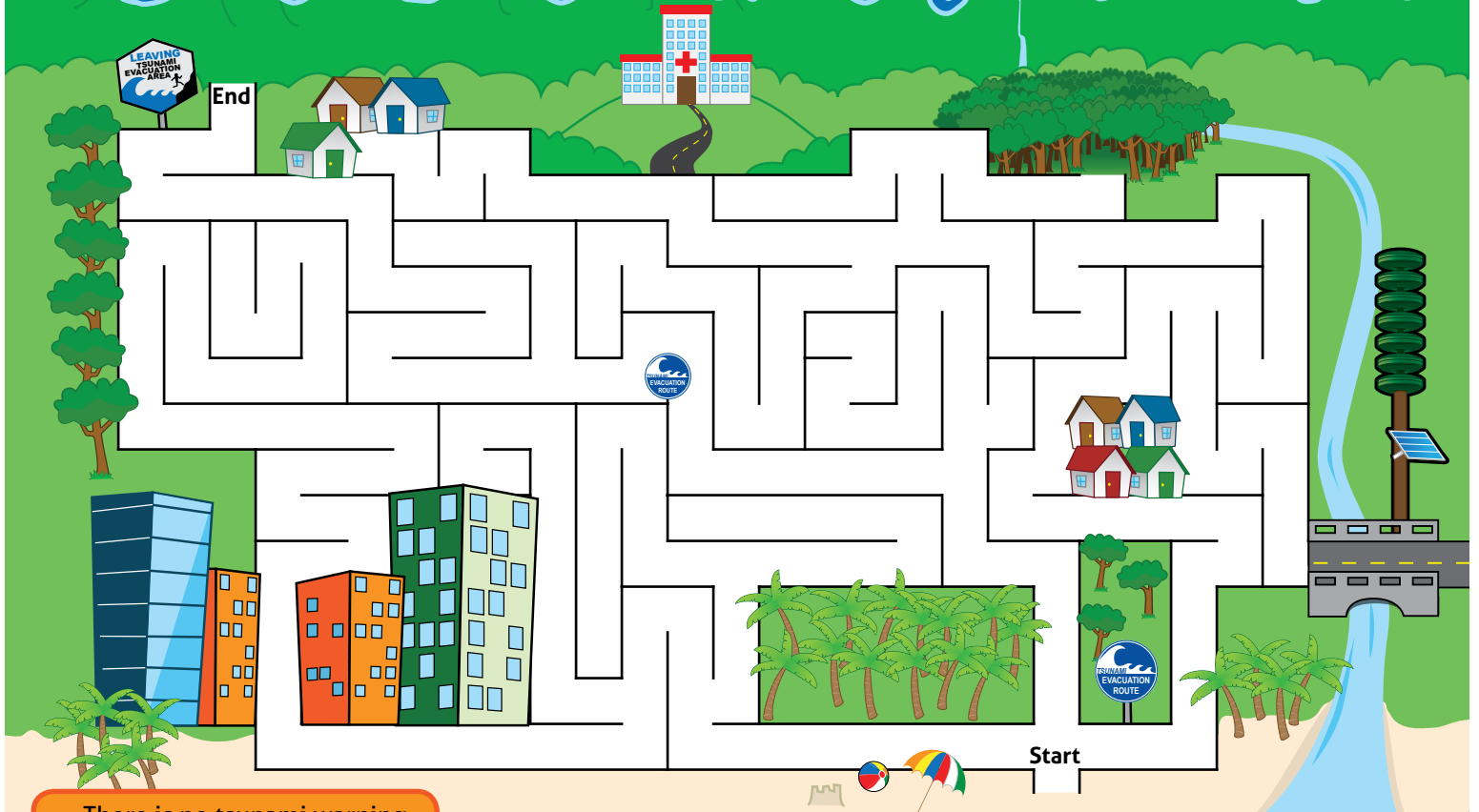
Draw an arrow from each word to its definition.

monitor	ca <u>u</u> sed or produced
seismograph	susceptible to dan <u>g</u> er or unprotected
generated	a tsunam <u>i</u> from a nearby source
locally generated tsunami	a tsunami from a far away source, generally more than 600 <u>m</u> iles (1000 km) away
distant tsunami	instrument used by <u>s</u> cientists to record and measure earthquakes
all clear	to keep <u>t</u> rack of or regularly check
vulnerable	the term used by local <u>a</u> uthorities to declare that the danger has passed

What do the underlined letters in each definition above spell out?

— U — — — —

Get Out of the Zone!



There is no tsunami warning signage on the island of O'ahu.



Superhero Challenge!

Work with your teacher and your 'ohana to find out if the following locations are in a Tsunami Evacuation Zone:

- Your home
- Your school
- Your parent's or guardian's place of work
- Your aunt, uncle or grandparent's homes
- Your favorite beach

No Ka 'Ohana

Teach your 'ohana (by speaking or writing directions) how to reach safety from their favorite beach.

Make your way out of the Tsunami Evacuation Zone to Safety!

Tsunami Evacuation Zones are places that can be very dangerous during a tsunami event. Tsunami Evacuation Zones have been created based on how far tsunami waves have come inland in the past. Tsunami Evacuation Zones often include rivers and streams because tsunami waves can be funneled up rivers and streams near the coast making them unsafe. **No coastline is safe during a tsunami, so always move inland to higher ground and stay away from rivers and streams.**

Homes, schools, businesses, hotels and, of course, beaches may lie in a Tsunami Evacuation Zone. To be safe, everyone in a Tsunami Evacuation Zone should have a tsunami evacuation plan which will lead them out of the danger zone quickly and safely when a tsunami is approaching.

Do you live, go to school, or play in a Tsunami Evacuation Zone? If you do, you should create a tsunami evacuation plan so that you can leave the unsafe area well before a tsunami strikes. You should also agree on an 'ohana meeting place, in case you are not together during a tsunami.

Parents: If your child goes to a school within a Tsunami Evacuation Zone, ask school officials about their tsunami evacuation plan. All schools in a tsunami evacuation zone in the State of Hawai'i should evacuate students to a designated safe area outside the Tsunami Evacuation Zone.

Our 'Ohana Evacuation Route

Once a **Tsunami Warning** is issued by the Pacific Tsunami Warning Center, County Civil Defense Agencies and the Department of Emergency Management will coordinate with State Civil Defense to sound the sirens.

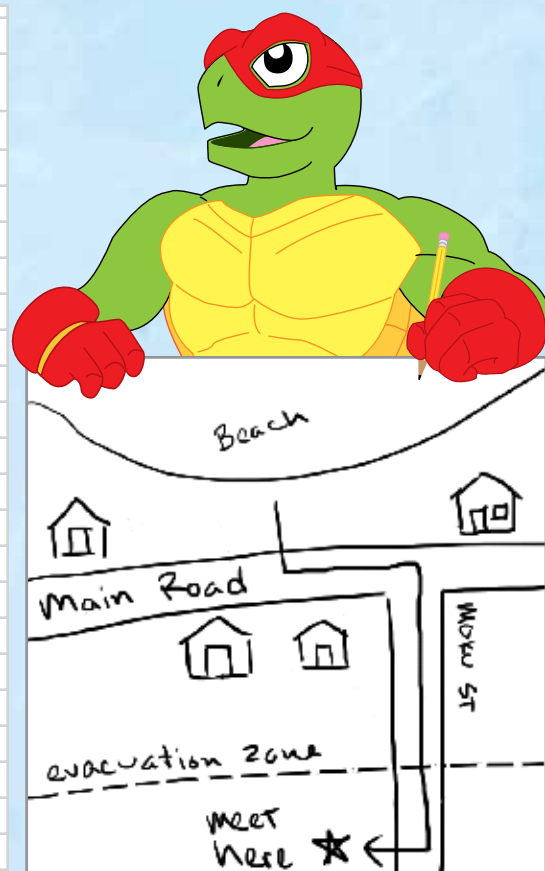
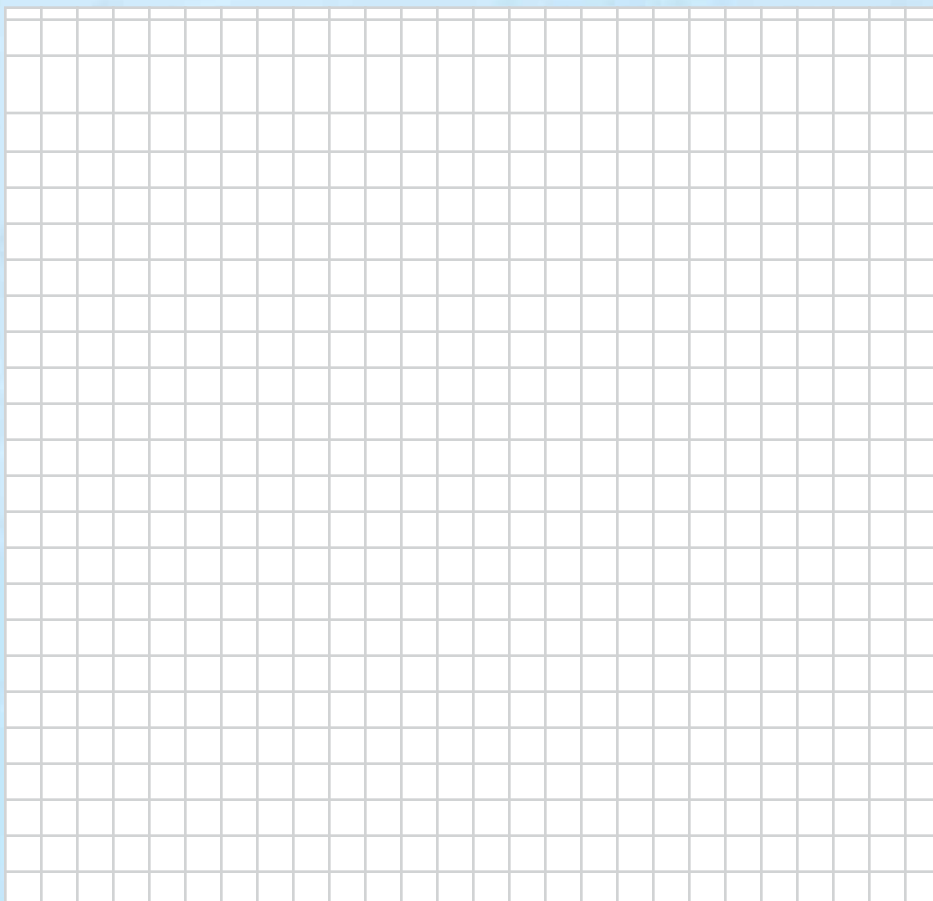
1. Sirens will sound.
2. Messages will be broadcast by radio and television.
3. Messages will be sent out over the internet and to some cell phones.
4. Police will set up roadblocks and may announce the messages over loudspeakers.
5. Civil Air Patrol planes with loudspeakers may fly over coastal areas and announce the message.

A Tsunami Warning means that everyone should evacuate the Tsunami Evacuation Zones immediately. In some cases, this may mean evacuating "up" to the third floor or above in buildings of six or more stories.

What if you are camping with your 'ohana at a remote fishing spot? Or on vacation outside Hawai'i where they may not have a Tsunami Warning System? What if you do not receive the warning message? You must know how to recognize Nature's warning signs; you can learn all about these on page 8.

No.Ka 'Ohana

Pick a place in the Tsunami Evacuation Zone that you spend the most time and draw and color a route out of the zone to safety. You should include street names and also your 'ohana meeting place. You can use the maps in the front of your local phone book and also the Hawai'i Tsunami Information Service (<http://csc.noaa.gov/psc/riskmgmt/tsunami.html>) to help you. Go over the route with your parents and discuss alternate plans should you be separated during an event.



Local Tsunami Evacuations

You have learned that Hawai'i is at risk from tsunamis that are generated right here in the islands. *Remember:* In the event of a locally generated tsunami you may only have minutes to evacuate. Look at the map of the Hawaiian Islands to see how quickly a locally generated tsunami can strike!

In a locally generated tsunami there may not be time for an official warning, so you must rely on Nature's warning signs.

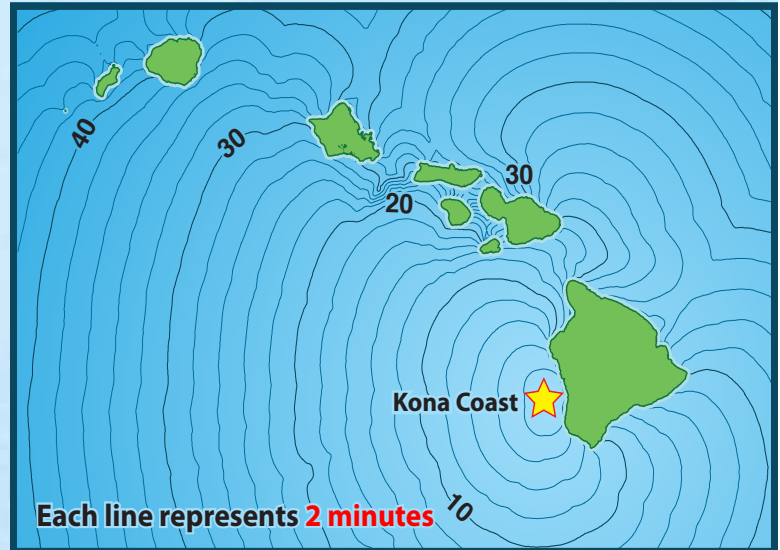
Because we know that earthquakes generate tsunamis, an earthquake may be your first warning that a locally generated tsunami is on its way!

Superhero Challenge!

Examine the Hawaiian Island Tsunami Travel Time Map above. Using the technique you learned to calculate tsunami travel times in the previous map of the Pacific Ocean, calculate how long it will take a tsunami from the Kona Coast ★ of the Big Island to reach your coastal community? _____ minutes



Hawaiian Islands Tsunami Travel Time Map



As you make your way quickly to safety from the ocean you may come across hazards. Circle six hazards that may cause harm to you or the environment.



It is **NOT** safe to get in a car to evacuate from a locally generated tsunami – you may get trapped. You should go immediately on foot to high ground, including evacuating “up” to the third floor or above in buildings of six or more stories.

Nei ka honua, he ōla'i ia.

*When the earth trembles, it is an earthquake.
We know by what it does.*

Use Your Senses!

Sometimes you must rely on your senses as a warning of an approaching tsunami. You **may** experience one or more of these natural warning signs:

Feel: An Earthquake.

See: Any unusual water or wave behavior including odd bubbles, whirlpools or water receding or **surging** inland.

Hear: An unusual noise from out to sea.

If you experience any of these signs, you should evacuate to high ground and tell others that a tsunami may be approaching. It is always better to be safe than sorry.

Keyword:
Surging = Rushing

What should you do?

Read the questions and circle or underline each correct answer.

1. If you feel an earthquake?

- Jump up and down
- Run away from your 'ohana or friends
- Drop, Cover and Hold On, then move quickly away from the coast after shaking stops
- Run towards the ocean



2. If you see the water recede or surge inland?

- Grab your surfboard
- Find a cool spot to watch
- Collect stranded fish from the rocks
- Move quickly and safely to higher ground



3. What do you think a tsunami might sound like?

- A loud train
- No sound
- A loud roar
- All of the above (*have been described by tsunami survivors*)



Remember, not all signs may be present in a tsunami event. If you experience one or more of the signs, you should evacuate – it is better to be safe than sorry!

Can animals sense earthquakes and tsunamis?

Just prior to an earthquake or the arrival of a tsunami, people in different places around the world have reported witnessing strange behavior of animals. In Thailand, elephants were seen running away from the coastline just prior to the December 26, 2004 tsunami. Birds have stopped singing, cows have begun leaping and cats and dogs have sought refuge in the strangest of places. Have you heard stories about animals behaving strangely before an earthquake or tsunami?



Tsunami vs. Coastline

The Ultimate Showdown



Tsunami waves may travel at the speed of a jet plane (*over 500 miles per hour*) in the deep ocean but someone on a **boat** in deep water might not even notice tsunami waves passing under them. As tsunami **waves** approach shore they begin to slow down, build up in height, and are changed by the depth of the water and the shape of the coast. In some places the waves may come ashore as a huge flood going inland for hundreds of yards, whereas in other places there may be very little flooding at all. Bays, **harbors**, coves, and the mouths of rivers are more likely to have greater flooding than steep shoreline areas with rocky cliffs. Remember that tsunami waves can also **wrap** completely around an island creating dangerous conditions even on the far side from which the tsunami is approaching.

A tsunami is never just one wave. There is always a series of waves with danger that can last for several hours. The first wave may not be the largest, so do not think it is **safe** to go back to the shore just because the first wave has passed. Always wait for an official **All Clear** message before returning to a coastal area.

If you are out in the deep ocean in a **boat**, you should not try to come to shore, instead stay out at sea and wait for the All Clear before returning to port (*always ensure you carry enough gas in the boat to get you back in safely*).

If you are out surfing, get ashore as quickly as you can. Never try to **surf** a tsunami. Tsunami waves are **NOT** surfing waves. There is no wave face to surf and tsunami waves are full of debris and cause dangerous currents.

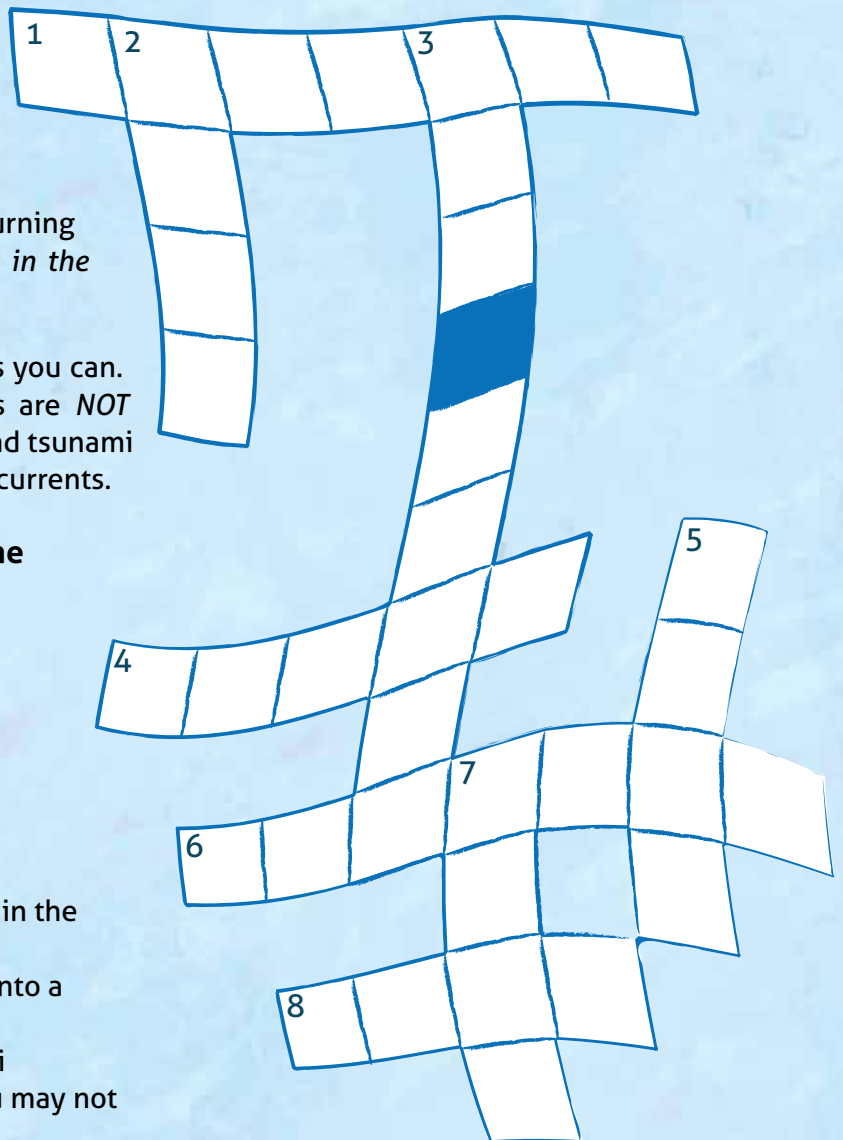
Use the words in bold to help you solve the crossword puzzle!

ACROSS

- 1 A series of dangerous waves
- 4 Tsunamis are made up of many of these
- 6 Places that are likely to get deep flooding
- 8 Tsunamis can do this around islands

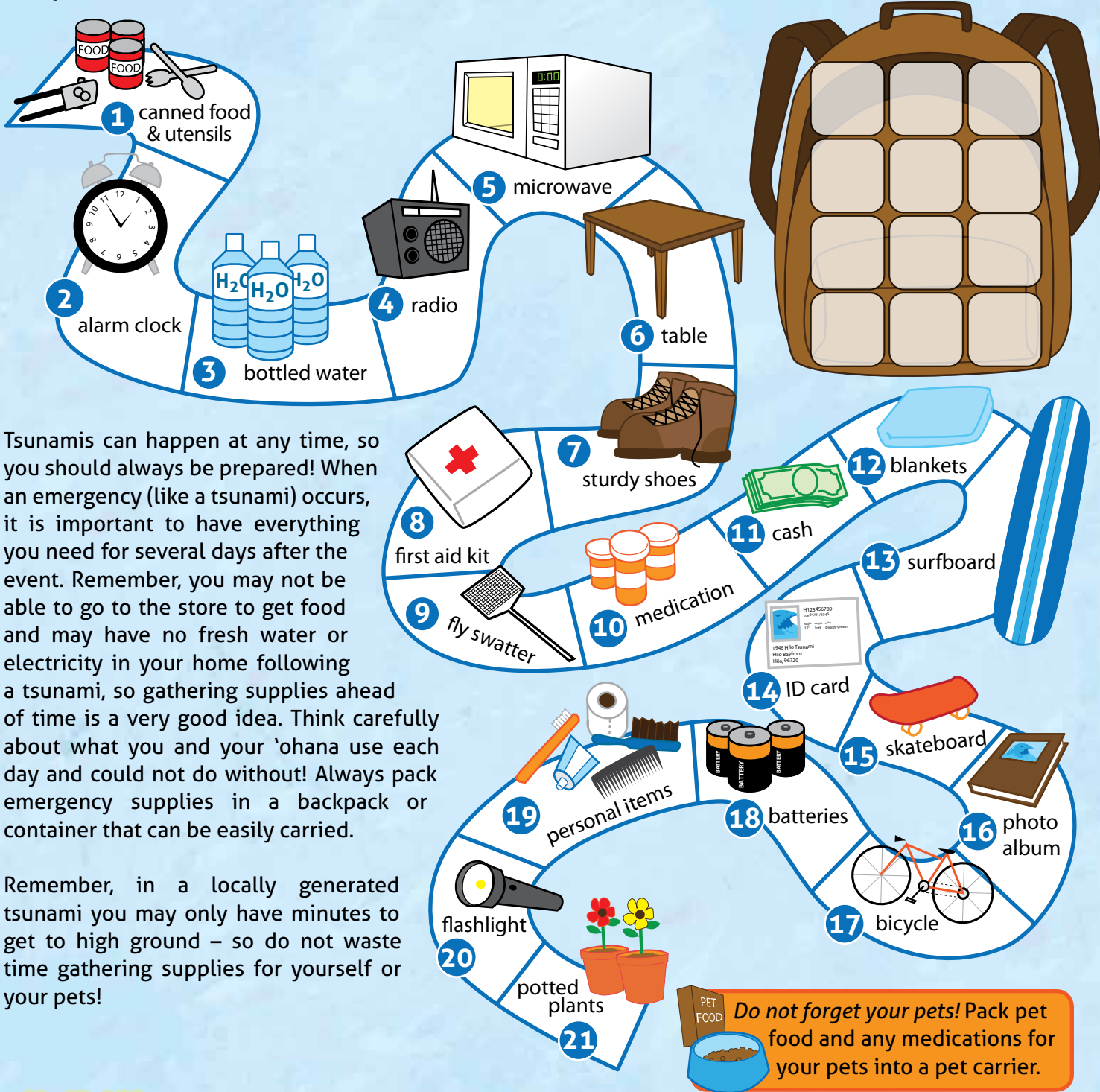
DOWN

- 2 If you learn about tsunamis you will be this in the next tsunami event
- 3 You should wait for this before going back into a Tsunami Evacuation Zone
- 5 You should never try to do this on a tsunami
- 7 If you are in one of these in deep water, you may not feel a tsunami



Emergency Kit

After reading through the text below, follow the path through the house picking up items to put into your emergency kit. But remember, you only have 12 spaces in your backpack, so you must only pick up the most important items. Place the number assigned to each item you choose in the backpack slots.



Tsunamis can happen at any time, so you should always be prepared! When an emergency (like a tsunami) occurs, it is important to have everything you need for several days after the event. Remember, you may not be able to go to the store to get food and may have no fresh water or electricity in your home following a tsunami, so gathering supplies ahead of time is a very good idea. Think carefully about what you and your 'ohana use each day and could not do without! Always pack emergency supplies in a backpack or container that can be easily carried.

Remember, in a locally generated tsunami you may only have minutes to get to high ground – so do not waste time gathering supplies for yourself or your pets!

Do not forget your pets! Pack pet food and any medications for your pets into a pet carrier.

No.Ka`Ohana

As an 'ohana, discuss why it is so important to have an emergency kit for tsunamis and also for emergencies like hurricanes. As an 'ohana, collect as many items for your kit as possible. Remember to let everyone in your 'ohana know where the emergency kit is located!



Our Tsunami Action Plan

Complete this plan and then post it in your home for all to see.

- Our 'ohana meeting places are _____
- Our 'ohana cell phone numbers *(remember, cell phones may not have service during an emergency)*

- Our out-of-state contact is _____
- Our emergency kit is located in _____
- Our important 'ohana papers are located in _____
- (If applicable)* The school pick up point is _____
- (If applicable)* We will be assisting with evacuation. _____
- (If applicable)* We will evacuate to our relative's or friend's home at _____

- Medications for our 'ohana are located in _____
- (If applicable)* Our pet carrier is located in _____
- (If applicable)* Our pet's food, bowls, medication are located in _____

Remember to put all of your emergency contact phone numbers into your cell phone or wallet as you may not have this action plan with you when a tsunami strikes!

