MeTEOR Performance Task
Seventh Grade

English Language Arts
On the Move

Performance Task Item: On The Move (Earth's Changing Landscape)

Part A:

Read "Plate Tectonics" and answer questions 1 - 4.

1. What is the oceanic crust? What is the continental crust?

2. What are two ways that mountains can be formed? Name some mountain ranges and identify the way they were formed.

3. When Pangea divided, what were the names of the landforms it created? These landforms continued moving apart and divided into continents. Can you find some commonalities these continents have today from the way they were divided? Some things to consider might be location, climate, seasons, etc.

4. After reading the text, what can you infer about the meaning of the words, ***convergent*** and ***divergent***? How are they used in the passage to help you understand their meaning? Research their meaning and see if you are correct.

Read "The Science of Earthquakes" and answer questions 5 – 7.

5. What is the tectonic plates' role in an earthquake?

6. List the attributes of an earthquake on the organizer provided using evidence from the text. Be specific and use appropriate academic vocabulary. You will use this information for a future project.

7. In a group of three, each participant will choose one from the headings in the article listed below. Each participant will read the information under the heading and summarize it in their own words and become an "expert" on that information. The "expert" will explain their information to the group.
    - What causes an earthquake and where do they happen?
    - Why does the Earth shake when there is an earthquake?
    - How can scientists tell where the earthquake happened?

Read "The Story of Tsunamis" and answer questions 8 and 9.

8. What are the three ways listed in the text that explains how Tsunamis are generated?

9. What does the word Tsunami mean and how does this definition relate to its attributes?

10. List the attributes of a Tsunami on the organizer provided using evidence from the text. Be specific and use appropriate academic vocabulary.

11. According to the article, it is currently impossible to predict where and when the next tsunami will strike, but once the course of events are set into action to generate a tsunami, there is some ability to predict some information. How is the information gathered? Why is this information important for the safety of the human race?

Part B:

Use the website http://www.tsunami-alarm-system.com/en/phenomenon-tsunami/phenomenon-tsunami-occurrences.html **to answer question 12.**

12. Research and list countries that have been or could potentially be affected by a Tsunami. What do you have to have to be able to use the Tsunami alarm system and why is it important?

13. Using the information from all three articles you have read and the provided cause and effect graphic organizer to show the progression of events that would start with plate tectonics and ends with a tsunami. Then write a causal (cause and effect) essay explaining the science behind a tsunami and the threats it brings to people.

14. Throughout the years, many people have perished through natural tragedies such as Tsunamis. In the United States, we have many ways to communicate warnings to our communities. In other countries, they may not have the same access to communication systems. Research a country besides the United States that would be affected by a Tsunami. (You can use your list from question 12) What warning system do they have in place? Is it effective? If one is not in place, what would be some ways that their current communication system could be enhanced to save lives? Write a letter to ask for funding from a fictional agency, "NEWS" (National Early Warning System), to either create or enhance the researched country's emergency notification system.

ARTICLES/STUDENT MATERIALS/RUBRICS

"Plate Tectonics"
www.readworks.org

Plate Tectonics
As solid as the earth may seem, there are always parts of its crust that are moving at an incredibly slow rate. Since the 1940s and 1950s, steady advancement in technology has allowed geologists to better understand the movement of the earth's plates and how these plates work.

The surface of the earth is made up of several crustal plates. Think of a massive puzzle. Instead of little cardboard cutouts, the puzzle pieces are gigantic slabs of rock that cover the earth. This "puzzle" sits right on top of the mantle's fluid and extremely hot layer, which is made up of several elements, the most prevalent being oxygen, silicon, and magnesium. The crust is divided into two types: oceanic crust and continental crust. As you can guess, the oceanic crust is composed of the pieces that cover the ocean floor, and the continental crust forms our continents.

Oceanic Crust
You may think that the ocean floor is stationary, meaning it doesn't move. However, that's not the case at all. The ocean floor is always moving, though at a very slow rate. In the past, geologists have mapped the ocean floor. By doing so, they discovered a large mountain range that lies underwater in between continents. This mountain range is called the Midoceanic ridge.

As we learned before, the mantle is found directly underneath crustal plates. Since the mantle is made of very hot material, we find "convection currents" within this layer of the earth. Hot material at the deepest part of the mantle rises, then cools once it reaches the surface, then sinks back into the mantle, only to be reheated and rise again, repeating the cycle. Convection currents in the mantle cause the oceanic ridges to rise and form mountains. This is where many scientists say new crust is being generated. The hot magma from the mantle rises up between tectonic plates and spreads outward. So, as this happens, the crust moves very slowly, carrying the continents with it. How slowly? Scientists measure the "spreading rate" in units of millimeters per year, with the faster rates measuring about 80 to 120 millimeters per year.

Types of Boundaries

Convergent boundaries are points at which tectonic plates move into one another. This can result in the formation of mountain ranges (like the Himalayas) as continental plates push against one another. Or it can result in something called subduction, where one plate rises over another as they collide, and the other sinks underneath. This also can form a mountain range, just in a different process. The plate that slowly slips underneath the other plate then melts in the mantle.

Divergent boundaries, on the other hand, are boundaries at which plates are pushed away from one another. These occur both in the ocean and on land. In the ocean, hot magma from within the earth rises out from deep sea trenches where the plates are pushed farther away from each other. On land, plates are pulled apart as part of a chain reaction beginning with the movements happening in the ocean. The Great Rift Valley in Africa is an example of this. If the plates continue to be pulled apart there, eastern Africa can split from the continent to form a new landmass. But that won't take place for millions of years since the process happens so slowly.

The last type is a transform boundary, one that involves plates sliding against each other. The San Andreas Fault in California is an example of this. The motion of tectonic plates sliding against one another can sometimes cause earthquakes, some quite large and devastating.

Transform boundaries are also called strike slip faults due to the motion they make. This type of relatively fast plate movement that causes earthquakes is the only one we can really feel. Since the other plate shifts are so slow and gradual, we don't feel them.

Pangaea

Scientists have discovered that our continents were not always the same shape or in the locations they are in now. Our continents have changed and drifted closer together or farther apart over the course of billions of years. The most recent time when all the continents were part of the same landmass happened about 300 million years ago. Scientists have named this huge landmass Pangea, calling it a "super-continent." It existed when dinosaurs roamed our planet. Seventy million years later, Pangea started to shift apart. When this happened, it broke into two pieces: Laurasia and Gondwana. Laurasia later broke up into Eurasia and North America, while Gondwana separated into Australia, South America, Africa, and Antarctica to make our earth look like it does today. And since our continents are still drifting, it is very possible that we will have another supercontinent hundreds of millions of years from now.

What information supports all of this? If you look closely at a map of the earth, you can kind of see where the continents possibly used to fit together. South America looks like it could slide right into Africa and the two would fit together. So scientists began to speculate. But it wasn't enough to assume our continents were once a single landmass just because they look like they could fit together. Therefore, scientists began looking at fossils on different continents. They found similar fossils on Australia and southern Asia. They also found that there were very similar types of rock on the western coast of Africa and the eastern coast of South America. The support lay in the fossils of the animals and plants on the different continents. We can only wonder what the earth will look like in another hundred million years!

“The Science of Earthquakes”
https://newsela.com/articles/govt-science-earthquakes/id/26756/

TOP: Myanmar residents gather as they inspect large cracks on a road two days after an earthquake struck near the northeastern city of Tachilek on March 26, 2011. Photo by: Soe Than WIN/AFP/Getty Images. SECOND: Earth has four main layers. Image from: Wikimedia. THIRD: P and S waves help scientists find an earthquake's location. BOTTOM: Earthquake early warning systems can help communities be prepared when an earthquake strikes. Images from: USGS.

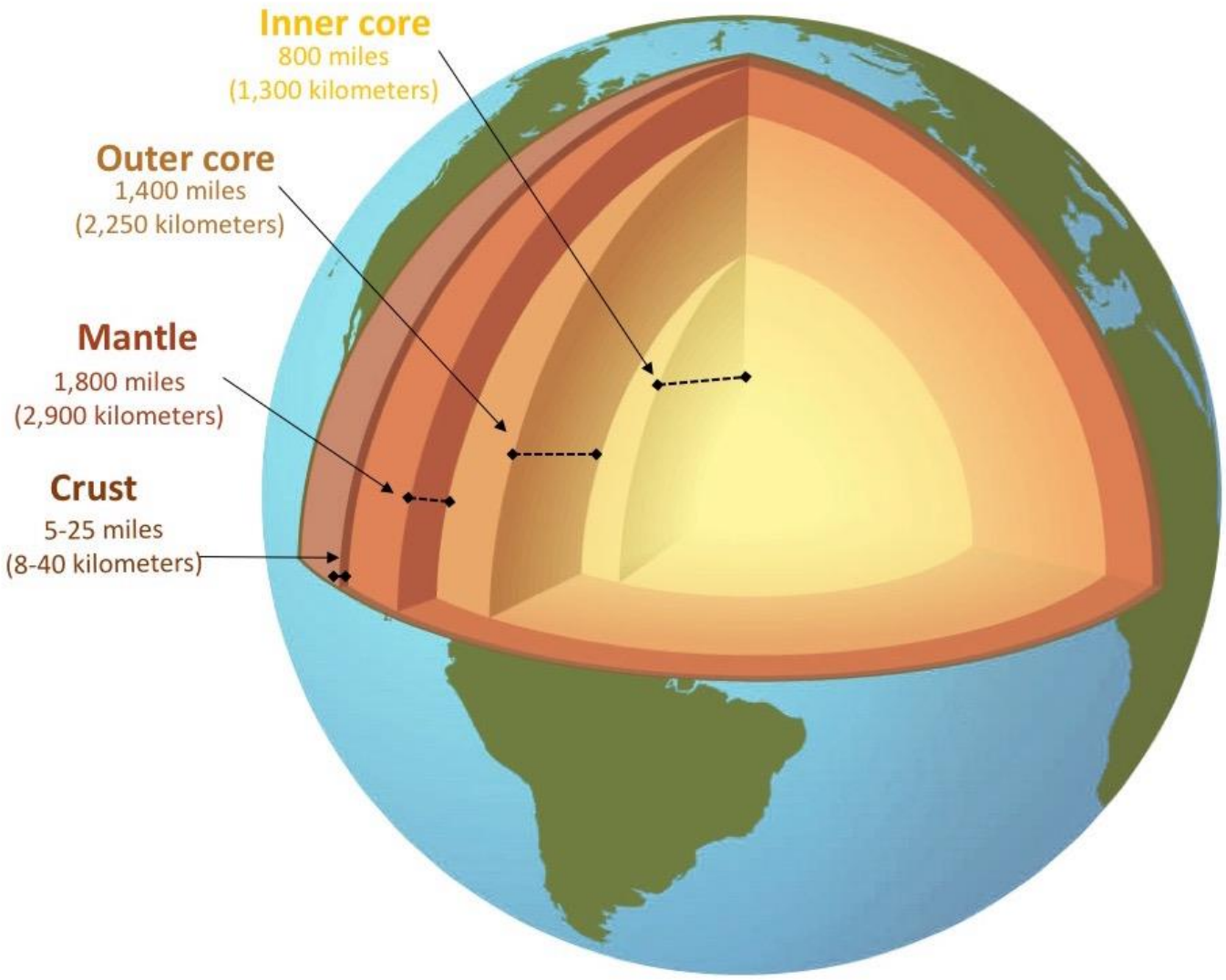
What is an earthquake?

An earthquake is what happens when two blocks of the earth called tectonic plates suddenly slip past one another. The surface where they slip is called the fault or fault plane. The location below the earth’s surface where the earthquake starts is called the hypocenter, and the location above it on the surface is called the epicenter.

Sometimes an earthquake has foreshocks. These are smaller earthquakes that happen in the same place as the larger earthquake that follows. Scientists can’t tell that an earthquake is a foreshock until the larger earthquake happens. The largest, main earthquake is called the main shock. Main shocks are followed by smaller earthquakes called aftershocks, which occur in the same place and can continue for weeks, months and even years after the main shock.

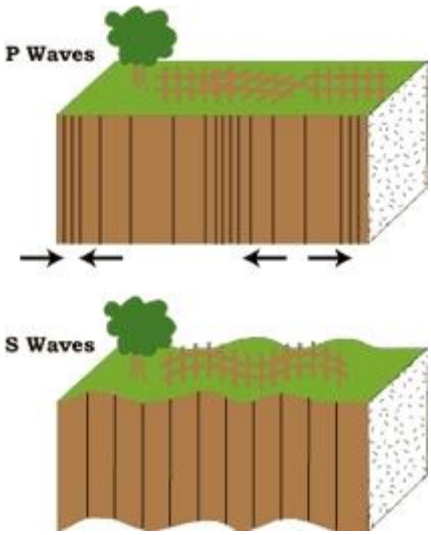
What causes earthquakes and where do they happen?

The earth has four major layers: the inner core, outer core, mantle and crust. The crust and the top of the mantle make up a thin skin on the surface of the planet. But this skin is not all in one piece – it is made up of many tectonic plates, like a puzzle covering the surface of the earth. Not only that, but these puzzle pieces keep slowly moving around, sliding past one another and bumping into each other. The edges of the tectonic plates are called the plate boundaries. The plate boundaries are made up of many faults, and most of the earthquakes around the world occur along these faults. Since the edges of each plate are rough, they get stuck while the rest of the plate keeps moving. Finally, when a plate has moved far enough, the edges come unstuck along one of the faults. The unsticking is what causes the earthquake.



Why does the earth shake when there is an earthquake?

While the edges of faults are stuck together, and the rest of the block is moving, the energy that would normally cause the blocks to slide past one another is stored. Once the jagged edges of the faults come unstuck, that energy is released. The energy is released in the form of seismic waves that spread from the earthquake source in all directions. When the waves reach the earth's surface, they shake the ground and everything on it.



There are different types of seismic waves that shake the ground in different ways and also travel through the earth at different speeds. The fastest wave, and therefore the first to arrive at a given location, is called the P wave. The P wave alternately squeezes and expands material in the same direction it is traveling. The S wave is slower than the P wave and arrives next, shaking the ground up and down and back and forth. The surface waves follow the P and S waves.

How are earthquakes recorded?

Earthquakes are measured by instruments called seismographs, which produce recordings called seismograms. The seismograph has a base that sits firmly in the ground, and a heavy weight that hangs free. When an earthquake causes the ground to shake, the base of the seismograph shakes too, but the hanging weight does not. Instead, the spring or string that the weight is hanging from absorbs all the movement. The difference in position between the shaking part of the seismograph and the motionless part is what is recorded.

How do scientists measure the size of earthquakes?

The size of an earthquake depends on the size of the fault and the amount of slip on the fault. However, that's not something scientists can easily measure since faults are located deep beneath the earth's surface. Instead, to measure an earthquake, scientists use seismogram recordings. The information from them can tell scientists the time, location and size of an earthquake.

How can scientists tell where the earthquake happened?

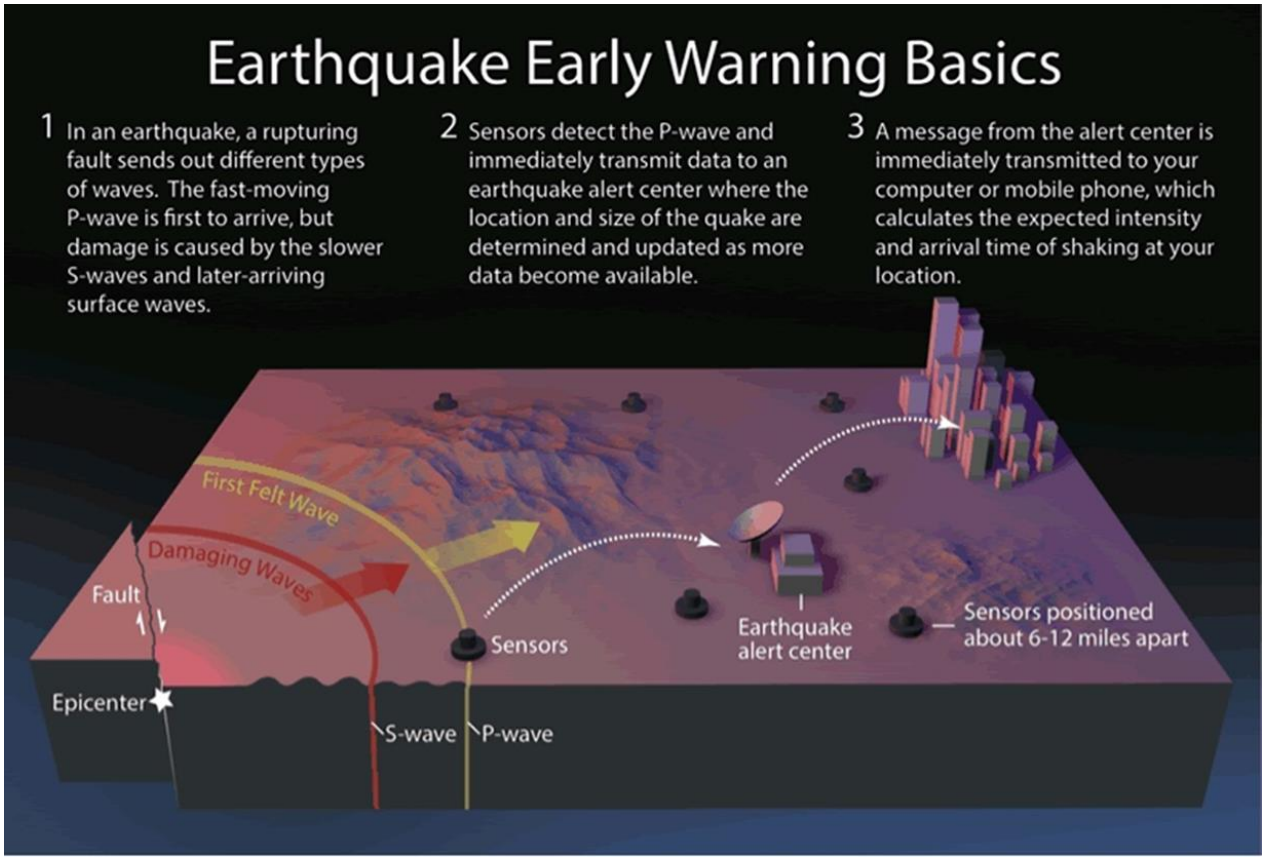
Scientists can tell where an earthquake took place because P waves are faster than S waves. To understand how this works, it helps to compare P and S waves to lightning and thunder. Light travels faster than sound, so during a thunderstorm you see lightning before you hear

thunder. If you are close to the lightning, the thunder will boom right after the lightning, but if you are far away from the lightning, you can count several seconds before you hear the thunder. The further you are from the storm, the more time between the lightning and the thunder.

P waves are like lightning, and S waves are like thunder. The P waves travel faster and shake the ground where you are first. Then the S waves follow and shake the ground also. If you are close to the earthquake, the P and S waves will come one right after the other, but if you are far away, there will be more time between the two. By looking at the amount of time between the P and S waves on a seismogram, scientists can tell how far away an earthquake was from a certain location.

Can scientists predict earthquakes?

On any particular fault, scientists know there will be another earthquake sometime in the future. However, it is difficult to tell exactly when it will happen. Earthquake early warning systems use earthquake science and monitoring systems to alert people when seismic waves are expected to arrive at their location. The seconds to minutes of advance warning give people a chance to protect life and property from destructive shaking.



“The Story of Tsunamis”
https://newsela.com/articles/govt-NOAA-tsunamis/id/26759/

Large waves seen at Point Lobos, California. Photo by: Amit Patel via flickr.

The story of tsunamis

A tsunami is a set of ocean waves caused by a large, sudden disturbance of the sea's surface. If the disturbance is close to the coastline, local tsunamis can destroy coastal communities within minutes. A very large disturbance can cause tsunami destruction both locally and thousands of miles away. Tsunami is a Japanese word that literally means "harbor wave."

Tsunamis are one of the deadliest kinds of natural disaster. Since 1850, they have killed more than 420,000 people and have caused billions of dollars of damage. Most of these losses were caused by local tsunamis that occur about once per year somewhere in the world.
Predicting when and where the next tsunami will strike is currently impossible. However, once the tsunami is generated, it is possible to forecast its arrival and severity.

Most Tsunamis Occur In the Pacific

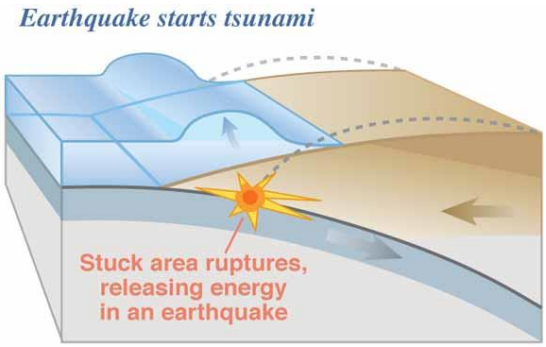
Tsunamis are most commonly generated by earthquakes in marine and coastal regions. Major tsunamis are produced by large, shallow earthquakes caused by shifts in oceanic and continental plates. Many thousands of miles across, these plates are enormous slabs of solid rock.

Tsunamis frequently occur in the Pacific, where dense oceanic plates slide under the lighter continental plates. When sections of a plate crack they can snap upward, agitating the ocean water. This occurred on Dec. 26, 2004, when a powerful earthquake struck the coastal region

of Indonesia. The movement of the seafloor produced a tsunami more than 100 feet high. More than 130,000 people were killed by that local tsunami. From this source, the tsunami radiated outward. Within two hours, it had claimed 58,000 lives in Thailand, Sri Lanka and India.

Underwater landslides caused by smaller earthquakes can also generate destructive tsunamis. A July 17, 1998 tsunami was generated by an earthquake that triggered a large underwater landslide. Three waves more than 23 feet high struck a six-mile stretch of Papua New Guinea coastline within 10 minutes of the earthquake. Three villages were completely swept away, leaving 2,200 people dead.

Explosive volcanoes and asteroid strikes can also generate tsunamis. The eruption of the Krakatoa volcano in Indonesia on Aug. 27, 1883 produced a 98-foot-high tsunami that killed over 36,000 people. Around 2 million years ago, a gigantic asteroid landed off the coast of Chile. It produced a huge tsunami that swept over portions of South America and Antarctica.



Usually, tsunamis are generated by earthquakes. The movement of the ocean floor releases energy which leads to larger-than-usual waves. Image from: Wikimedia.

Earthquakes an Indicator of a Tsunami's Likelihood

Since 1946, the tsunami warning system has provided warnings of possible tsunami danger. The system monitors both earthquake activity and wave behavior. However, it is still impossible to accurately predict how strong a tsunami will be at a particular location.

By monitoring earthquakes, scientists are able to estimate the likelihood of a tsunami. In particular, they look at earthquake size and location. However, this method provides no direct information about the tsunami itself.

Tide gauges along coasts provide direct measurements of the tsunami. However, local factors such as the depth and shape of the ocean floor, as well as the shape of the coastline, can influence the strength of a tsunami. That makes it difficult to use information from one location to make predictions about another location. Because of this, warning systems have often issued false alarms. In these cases, the tsunami that arrived was too weak to cause damage.

The tsunami warning centers depend on a global network of observation systems. They provide information on earthquakes and water level changes around the world. When an earthquake occurs, seismic networks provide information about its location, depth and strength. The warning centers study this information to determine if the earthquake could have generated a tsunami. They then must decide if a tsunami warning is necessary.
If a tsunami seems possible, the warning centers turn to water level information. They look for changes in water level height that could indicate the existence and size of a tsunami. Information about water level change comes from coastal water level stations, and from a network of deep-ocean systems.

Tsunami Deaths Have Declined Over the Years
In recent years, two things have helped reduce the number of deaths caused by tsunamis. One is computer modeling, which can predict how a tsunami will behave. The other is the deep-ocean tsunami detector. Of course, it is also vitally important that local populations are educated about tsunamis and that local governments have an evacuation plan in place.

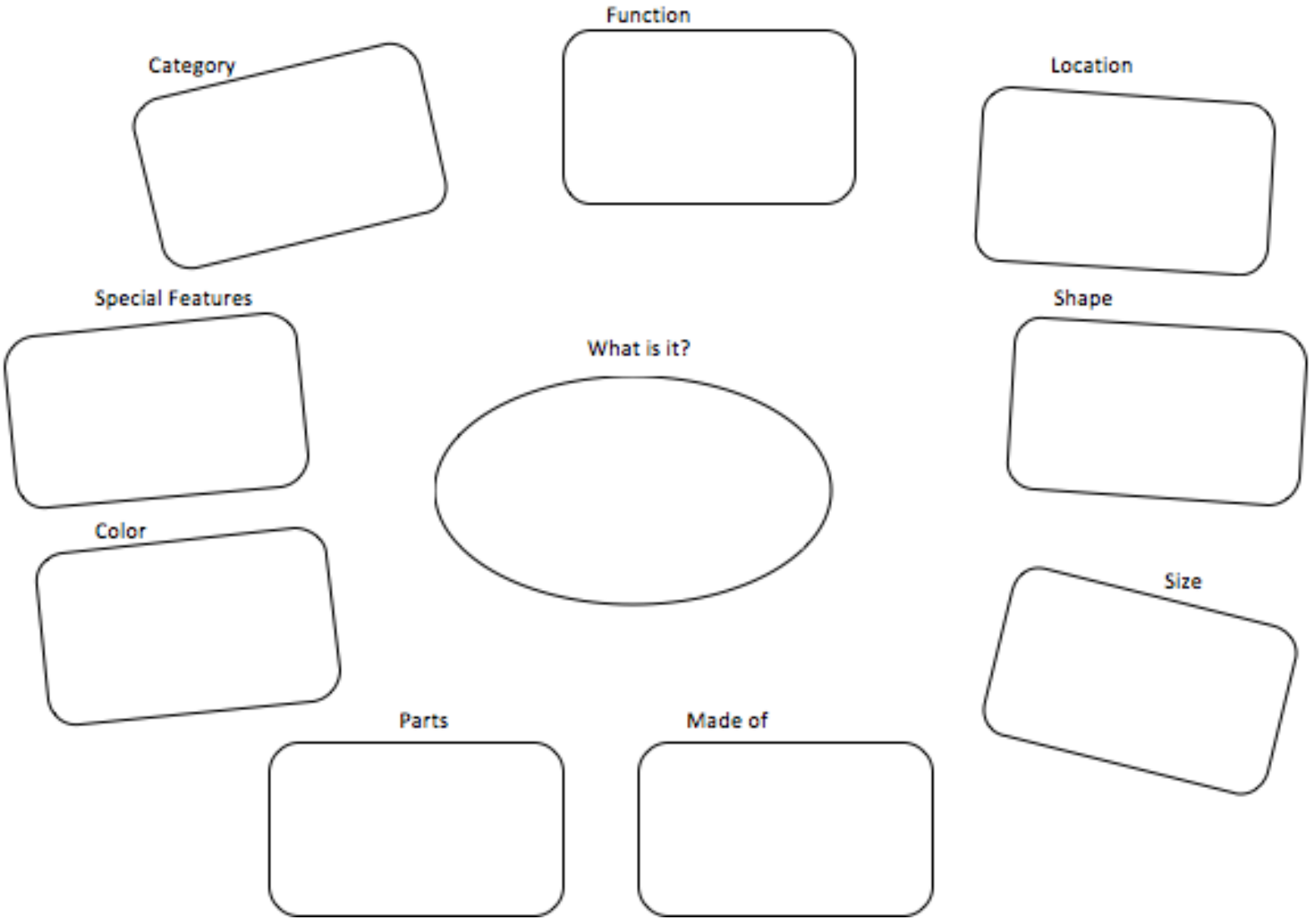
These points can be illustrated by comparing two communities hit by tsunamis.

In 1993, the town of Aonae, Japan, was hit by a tsunami. In this case, the population was educated about tsunamis, evacuation plans had been developed and a warning was issued. As a result, only about 15 percent of the population at risk died.

The story was very different when a tsunami hit Warapa, Papua New Guinea, in 1998. About 40 percent of the at-risk population died. In this case, the population was not educated about tsunamis, no evacuation plan was available and no warning system existed.

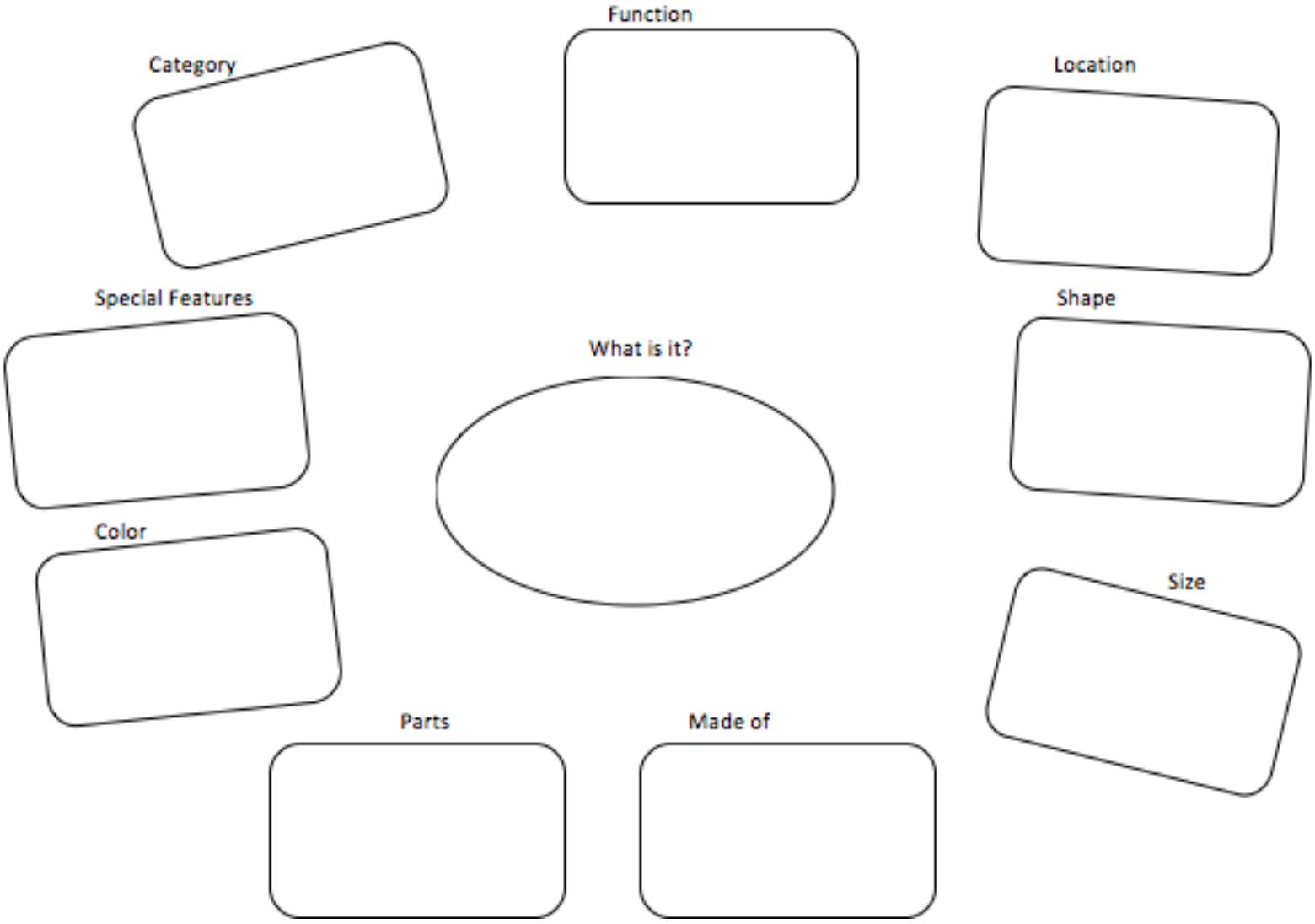
Name:
Date:

List the attributes of an Earthquake

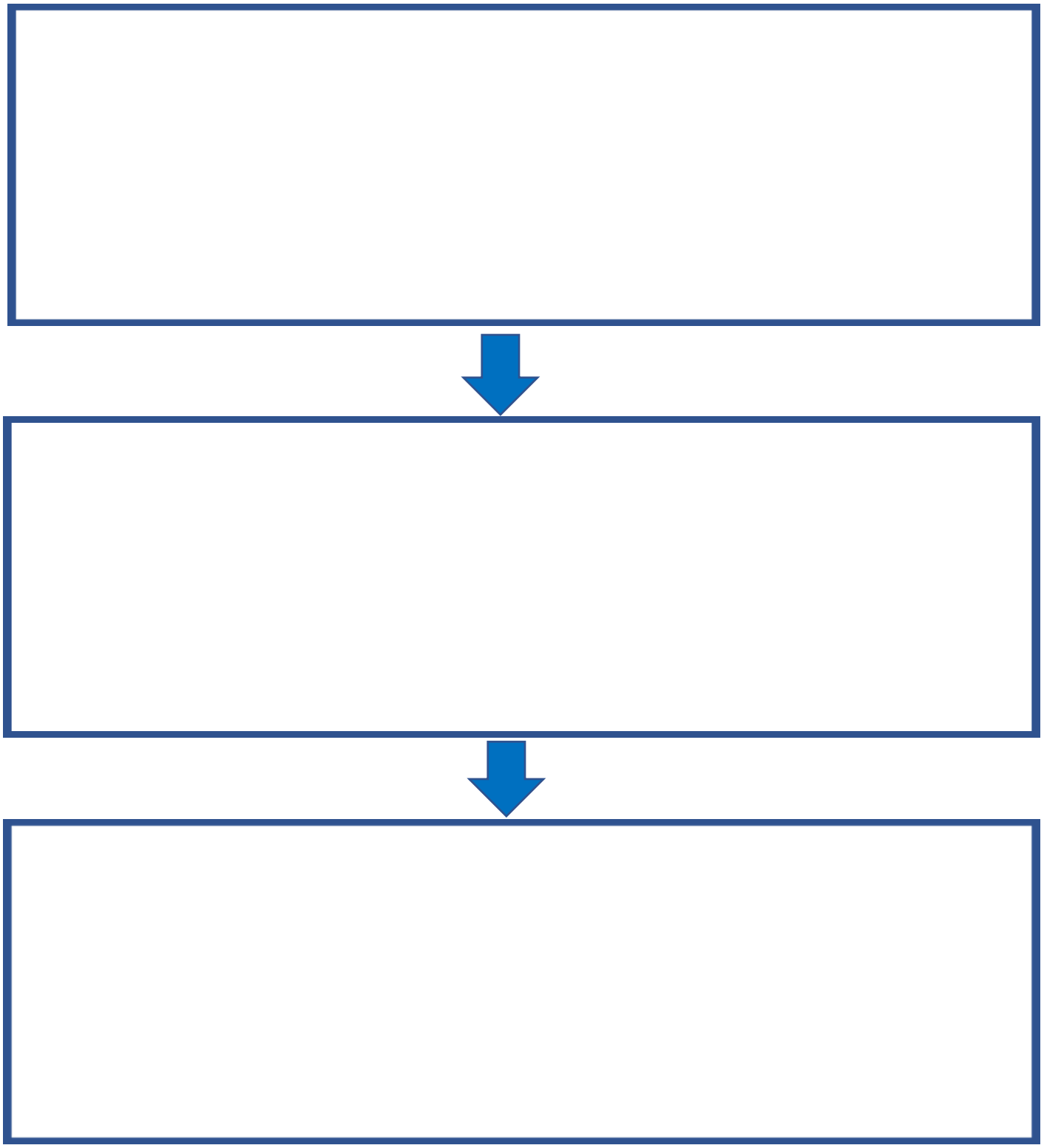


Name:
Date:

List the attributes of a Tsunami



Using the information from all three articles read, complete this cause and effect graphic organizer to explain the events that begin with the movement of plate tectonics and ends with the effects of a tsunami.



CAUSE AND EFFECT STRUCTURE WORDS

X is used to indicate a cause, while **Y** is used to indicate the effect.

Note: These phrases can be used in your causal essay:

Cause

- The first cause of (Y) is (X)
- The next reason is (X)
- Because of (X), (Y)
- As a result of (X), (Y)
- As a consequence of (X), (Y)
- because/since/as (X)
- (X) results in (Y)
- to be the result of (X)
- (Y) is due to (X)
- Owing to (X), (Y)
- (Y) is because of (X)
- (Y) is the effect of (X)
- (Y) is the consequence of (X)

- Worsening pollution levels in cities are **due to** the increased use of cars.
- **As a result of** the increased use of cars, pollution levels in cities are worsening.
- **The effect of** the increased use of cars is a worsening of pollution levels in cities.

Effect

- The first effect of (X) is (Y)
- As a result, (Y)
- As a consequence, (Y)
- Consequently (Y)
- Therefore, (Y)
- Thus (Y)
- Hence (Y)
- (X) results in (Y)
- (X) causes (Y)
- (X) has an effect on (Y)
- (X) affects (Y)
- (X) is one of the causes of (Y)
- (X) is the reason for (Y)

- Cars are used increasingly for urban transport. **As a consequence**, pollution levels in cities are worsening.
- Increased use of cars for urban transport adversely **affects** pollution levels in cities.
- Increased use of cars for urban transport **is one of the causes of** worsening pollution levels in cities.

Causal Essay Checklist

Below is a checklist for the main body of an essay. Use it to check your own writing, or get a peer (another student) to help you.

Item	OK?	Comment
The essay is a cause and effect essay.		
An appropriate structure is used, either block or chain (cause/effect graphic organizer used for prewriting).		
Cause and effect structure words are used accurately.		
The essay has a clear thesis statement.		
Each paragraph has a clear topic sentence.		
The essay has strong support (facts, reasons, examples, etc.).		
The conclusion include a summary of the main points.		

Comments:

Name:

Causal Essay (Cause and Effect) Rubric

Key Traits	Excellent - 4	Good- 3	Fair- 2	Minimal - 1
IDEAS	• The thesis statement is compelling and clearly presents the cause-and-effect relationship. • Key ideas are supported by relevant and specific details and examples.	• The thesis statement is focused and presents the cause-and-effect relationship. • Key ideas are supported by specific details and examples.	• The thesis statement presents the cause-and-effect relationship, but it is too broad or too narrow. • More and/or specific details and examples are needed to support the key ideas.	• The thesis statement is missing. • Details and examples are irrelevant or missing.
ORGANIZATION	• The introduction is engaging and clearly presents the cause-and-effect relationship. • The conclusion summarizes the ideas and offers an observation. • Transitional words and phrases show how ideas connect. • The organization is consistent and logical for cause-and-effect writing.	• The introduction presents the cause-and-effect relationship. • The conclusion summarizes the ideas. • A few more transitions are needed. • The organization is logical but occasionally inconsistent.	• The introduction vaguely presents the cause-and-effect relationship. • The conclusion summarizes some of the ideas from the essay. • Many more transitions are needed. • The organization shows some logic but is often inconsistent.	• The introduction does not set up what the essay is about. • The essay lacks a conclusion. • Few, if any, transitional words are used. • The organization seems random; the reader often feels confused.
WORD CHOICE	• Words are specific and create memorable pictures to help readers grasp the cause-and-effect relationship.	• Words are adequate and correct and sometimes capture the reader's imagination.	• Words are mostly correct but are often inadequate and do not capture the reader's imagination.	• Limited vocabulary and/or frequent misuse of parts of speech interfere with understanding.
SENTENCE FLUENCY	• Sentence beginnings, lengths, and structures vary.	• Sentence beginnings, lengths, and structures vary somewhat.	• Sentence beginnings, lengths, and structures do not significantly vary, and some fragments and run-on sentences are present.	• Repetitive sentence structure, fragments, and run-on sentences make the writing difficult to follow.
CONVENTIONS	• Spelling, capitalization, and punctuation are correct. • Grammar and usage are correct. • Paragraphing is correct and reinforces the organization.	• Spelling, capitalization, and punctuation are generally incorrect. • Grammar and usage do not distort meaning but are not always correct. • Paragraphing tends to be correct and reinforces the organization.	• Spelling, capitalization, and punctuation are often incorrect. • Grammar and usage errors distract from meaning. • Paragraphing is attempted but is not always sound (irregular or too frequent).	• Common words are misspelled and almost all punctuation is missing or incorrect. • Grammar and usage mistakes are frequent and distort meaning. • Paragraphing is missing.

Name:

Letter Writing Rubric

Category	Excellent - 4	Good - 3	Fair - 2	Minimal - 1
Structure	Piece has a well-defined opening statement, body and concluding remarks.	Follows most accepted formatting guidelines and is the requested length.	Piece lacks more than one of the following: defined opening statement, body and concluding remarks.	Piece is uneven and fragmentary.
Business Letter Format	Follows the accepted standard formatting guidelines and is the requested length.	Piece lacks one of the following: defined opening statement, body and concluding remarks.	Does not follow standard formatting guidelines and is over or under the requested length.	Does not follow the accepted formatting guidelines and is significantly over or under requested length
Topic/Support	Most major points supported with specific detail	Some points supported by specific details.	Most points supported by general statements.	Attempt at support.
Spelling and Conventions	Writing evidences understanding of proper grammar and use of punctuation throughout. All words spelled correctly.	Writing contains one or two consistent grammatical errors or incorrect uses of punctuation. Most words spelled correctly.	Many sentences are characterized by grammatical errors or incorrect uses of punctuation. There are numerous spelling errors.	Writing does not use proper grammar or punctuation and contains numerous errors. The spelling errors distract from the readability of the piece.
Language	Uses vocabulary that is precise with an awareness of the audience and the purpose.	Uses vocabulary that is appropriate with some awareness of the audience and the purpose.	Uses basic vocabulary with little awareness of the audience or the purpose.	Uses vocabulary that is unsuitable for the audience or the purpose.

TOTAL _____