

# NATURAL HAZARD DESIGN SOLUTION

differentiated passages 

780L Name: \_\_\_\_\_ Date: \_\_\_\_\_  
**Manila Flood Plan**

Manila is the capital of the Philippines. The Philippines is an island country in Southeast Asia.

980L Name: \_\_\_\_\_ Date: \_\_\_\_\_  
**Manila Flood Plan**

Manila is the capital of the Philippines, an island country of Southeast Asia in the Pacific Ocean. This city is on the island of Luzon along the shore of Manila Bay. It's at the mouth of the Pasig River. Manila is the Philippines' center for economy, politics, and social activity. Around 14 million people live in this city, but flooding makes this area a difficult place to live.

Floods take lives, destroy buildings, and affect the landscape of Manila. There have been many damaging floods in this area. Manila floods easily for many reasons. One reason is that the Philippines gets hit with about 20 typhoons per year. These typhoons have also gotten worse due to **climate change**.



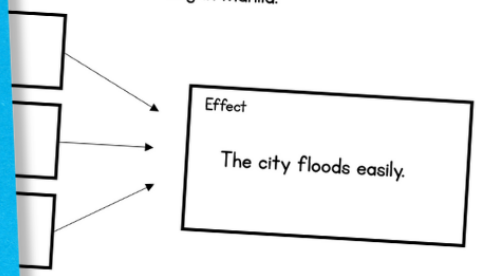
A flooded street in Manila, Philippines.

Typhoons are circular storms that begin over warm, tropical waters. They have high winds and heavy rain. The paths of these typhoons have become unpredictable as well. They now travel over parts of the Philippines that did not have as many typhoons in the past. This leaves people unprepared for the wild weather.

Another reason Manila floods so easily is due to **urbanization**. This means the area has lost its natural places such as forests that once could absorb the rains. Homes, parking lots, and other city structures now cover the area. Roads serve as funnels for rainwater, allowing it to rush into places that don't have good drainage systems. Many of Manila's waterways are also full of solid waste so their levels rise quickly. They also get blocked when storms dump rain on the area.

## Manila Flood Plan Questions

1. Use the chart to show the causes of flooding in Manila.



What are the causes of flooding in Manila?

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\_\_\_\_\_

What solutions have been created to help with the floods?

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\_\_\_\_\_

When was the solution even thought it was set to finish in 2004?

\_\_\_\_\_

\_\_\_\_\_



# ABOUT LEXILE LEVELS



MagiCore Learning, LLC is a certified Lexile® Partner. These texts are officially measured and approved by Lexile and MetaMetrics® to ensure appropriate rigor and differentiation for students.

The Lexile Framework® for Reading measures are scientific, quantitative text levels. When the Lexile of a text is measured, specific, measurable attributes of the text are considered, including, but not limited to, word frequency, sentence length, and text cohesion. These are difficult attributes for humans to evaluate, so a computer measures them.

Common Core State Standards uses Lexile level bands as one measure of text complexity. Text complexity ranges ensure students are college and career ready by the end of 12<sup>th</sup> grade. Lexile measures help educators scaffold and differentiate instruction as well as monitor reading growth.

Grade Band	Lexile® Bands Aligned to Common Core Expectations
K-1	N/A
2-3	420L-820L
4-5	740L-1010L
6-8	1185L-1385L

Keep in mind when using any leveled text that many students will need scaffolding and support to reach text at the high end of their grade band. According to Appendix A of the Common Core Standards, "It is important to recognize that scaffolding often is entirely appropriate. The expectation that scaffolding will occur with particularly challenging texts is built into the Standards' grade-by-grade text complexity expectations, for example. The general movement, however, should be toward decreasing scaffolding and increasing independence both within and across the text complexity bands defined in the Standards."



# Natural Hazard Design Solution

4<sup>th</sup> grade

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3. Hurricane Katrina Flooding (780L, 990L)
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5. Eldfell Volcano (780L, 990L)
6. Beast Quake (790L, 980L)
7. Earthquake-proof Buildings (790L, 980L)

Each passage set includes two differentiated passages on a fourth-grade level (one at the beginning of the band, one towards the end) and a question set geared towards comprehension and science mastery. The first question is differentiated to include a fill-in-the-blank diagram (lower complexity) or an open-ended diagram (higher complexity).

# How to Use This Resource

This resource was created with the NGSS Science Standards in mind. It includes six differentiated passages aligned to the following standard:

## *4-ESS3-2: Natural Hazard Design Solution*

Generate and compare multiple solutions to reduce the impacts of natural earth processes on humans. (Cause and Effect)

**Clarification Statement:** Examples of solutions could include designing an earthquake-resistant building and improving the monitoring of volcanic activity.

**Assessment Boundary:** Assessment is limited to earthquakes, floods, tsunamis, and volcanic eruptions.

**Here are some suggestions for using these passages:**

- Use as independent work after you have taught an overview of this standard. Assign the different levels based on the passage students can read and comprehend independently.
- Use as a reading center to reinforce key comprehension and science concepts at the same time!
- Use as a homework or review packet.
- Use as an intervention for students who need to revisit science concepts.



# Manila Flood Plan

Manila is the capital of the Philippines. The Philippines is an island country in Southeast Asia in the Pacific Ocean. This city is on the island of Luzon along the shore of Manila Bay. It's at the mouth of the Pasig River. Manila is the Philippines' center for economy, politics, and social activity. Around 14 million people live in this city. Flooding makes this area a difficult place to live.

Floods take lives. They destroy buildings and affect the landscape of Manila. There have been many damaging floods in this area. Manila floods easily for many reasons. One reason is that the Philippines gets hit with about 20 **typhoons** per year. These typhoons have also gotten worse due to **climate change**. Typhoons are circular storms that begin over warm, tropical waters. They have high winds and heavy rain. The paths of these typhoons have become unpredictable as well. They now travel over parts of the Philippines that did not have as many typhoons in the past. This leaves people unprepared for the wild weather.



A flooded street in Manila, Philippines.

Another reason Manila floods so easily is due to **urbanization**. This means the area has lost its natural places such as forests. These natural places were able to absorb the rains. Homes, parking lots, and other city structures now cover the area. Roads act as funnels for rainwater. This allows rain to rush into places that don't have good drainage systems. Many of Manila's waterways are also full of solid waste, so their levels rise quickly. They also get blocked when storms dump rain on the area.

A third reason for flooding in Manila is that the city is sinking. Taking groundwater with wells has caused Manila to settle lower. The effects of **global warming** are making the sea levels rise, too. Manila is vulnerable to increased water from harsh typhoons dropping rain from above. The Pacific Ocean creeps farther onto land at the same time.

The Philippine government designed a plan to deal with flooding. The Metro Manila Flood Management Plan was approved in 2012. It has solutions for managing major flood events. First, the plan wants to reduce flooding from rivers.



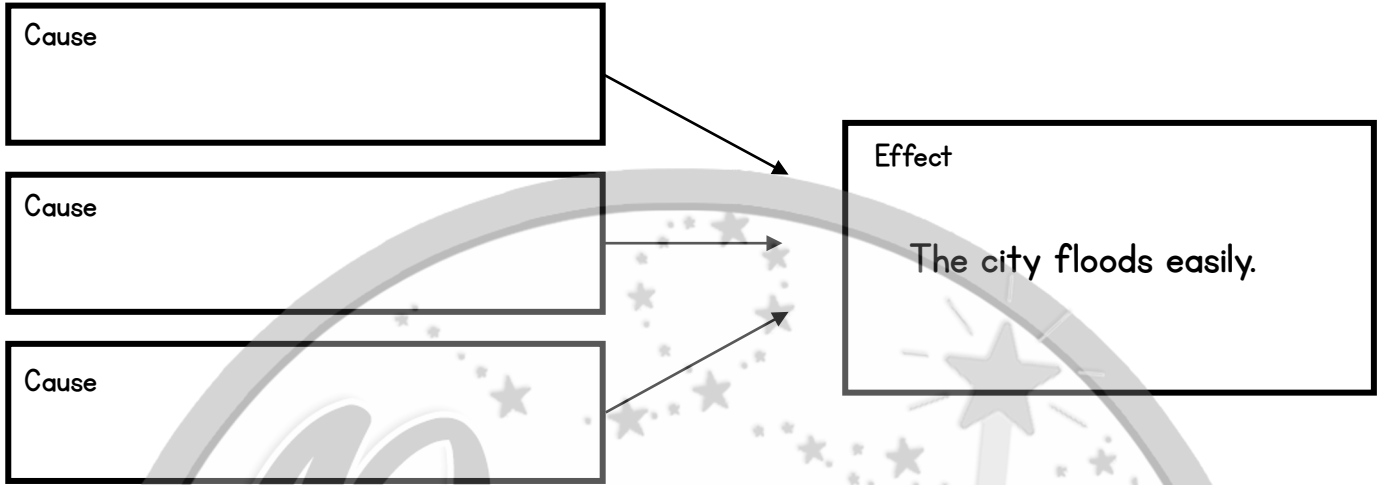
Example of the kind of dam that could be built in the upper Marikina River.

Building a dam in the upper Marikina River will help with this. Next, drainage in the city will be improved. This will allow water to be properly pumped out. Flood forecasting and early warning systems will be better developed. People will have warnings of flooding. The plan also calls for improvement in handling solid waste in the city. The waste won't end up in waterways. It won't act as a barrier to water flow.

The parts of this flood plan were created to solve the problems flooding causes in Manila. The World Bank received a grant to help pay for the plan. These projects were set to be completed by 2024. As of today, none of the pieces have been finished. Officials say lack of funds, disruption to traffic in the city, and poor management of the projects are to blame. Some people are trying to breathe new life into this plan to protect Manila from flooding.

# Manila Flood Plan Questions

1. Use the chart below to show the causes of flooding in Manila.



2. How has urbanization contributed to flooding in Manila?

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3. What plan has the Philippine government created to help with the floods?

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4. Why has the plan not been completed even though it was set to finish in 2024?

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A third reason for flooding in Manila is that the city is sinking. Taking groundwater with wells has caused Manila to settle lower. The effects of **global warming** are making the sea levels rise, too. Manila is vulnerable to increased water from harsh typhoons dropping rain from above. At the same time, the Pacific Ocean creeps farther onto land as time passes.

The Philippine government designed a plan to deal with the flooding of Manila. The Metro Manila Flood Management Plan was approved in 2012. It has solutions for managing major flood events. First, the plan seeks to reduce flooding from rivers by building a dam in the upper Marikina River. Next, drainage in the city will be improved so water is properly pumped out. Flood forecasting and early warning systems will be better developed so people can have warnings of flooding. The plan also calls for improvement in handling solid waste in the city, so it doesn't end up in waterways and act as a barrier to water flow.

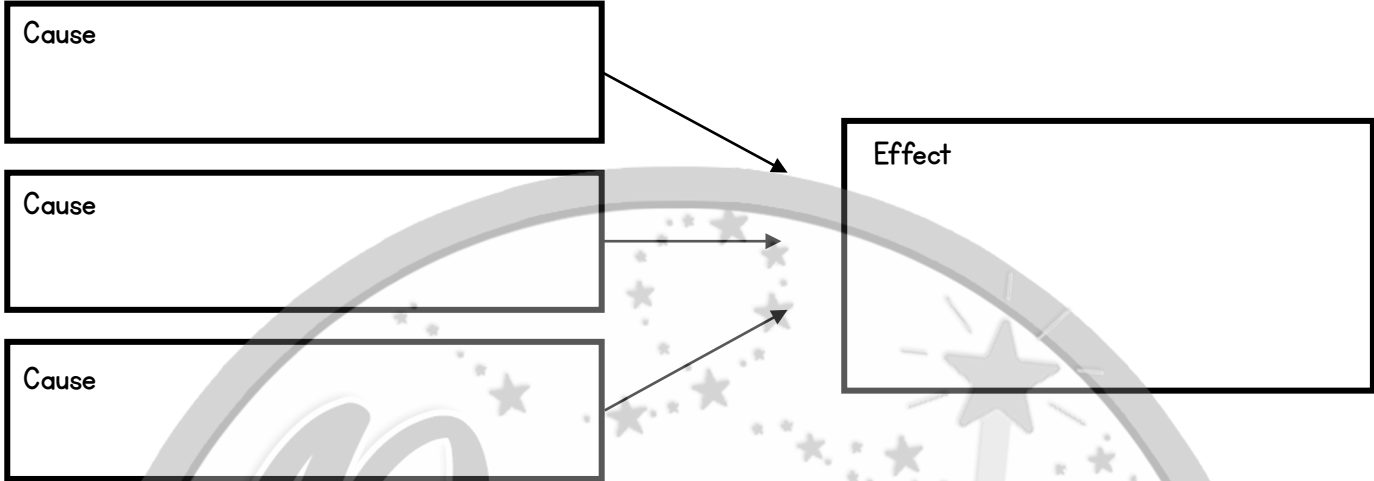


Example of the kind of dam that could be built in the upper Marikina River.

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## Eldfell Volcano

Eldfell is a volcano located off the southern coast of Iceland on the island of Heimaey. On January 23, 1973, this volcano erupted through a **fissure** almost 2 kilometers long. This happened near the town of Vestmannaeyja. Hot, molten lava poured out of Eldfell and headed for the town that had 5,300 people living there. No volcanic activity had happened here for 5,000 years before this eruption.

What is so unusual about this eruption is that humans fought back against the volcano. The town depended on fishing to make money. Eldfell's eruption threatened that industry. Its lava flows were bent on burning everything in their paths. All of the residents safely left the town because there was an **evacuation** plan. They were worried, however, about the harbor of Heimaey. This was where their fishing fleets were. The lava moved quickly in that direction. The flows threatened to close off the harbor. The main way people made a living there would be lost.



Eldfell volcano eruption in 1973.

Then, a possible solution came. Heimaey was an island. It had access to tons of water around it. The plan was to pump the icy-cold seawater onto the lava to cool it quickly. Work began with pipes and pumps in February. Millions of gallons of seawater were dumped onto the lava flowing from Eldfell. The eruption and the pumping of water lasted until July.



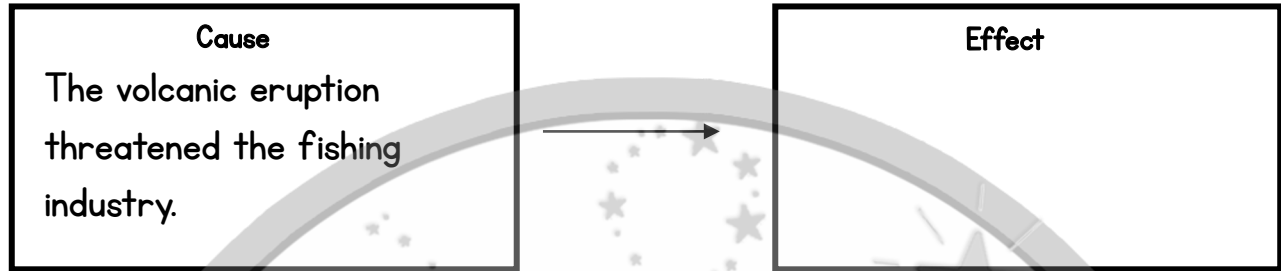
**Aerial view of Eldfell with the town and the ocean in view in the background.**

People who lived in the town returned. Everything was covered in lava and ash. They cleared the rubble and rebuilt the buildings the eruption had destroyed. They were able to use the cooling lava flows as heat for water and electricity. Ash from the volcano's activity was used as landfill for building roads and an airport runway.

Volcanoes are powerful forces of nature, but humans are creative and determined. Perhaps one day, methods that are guaranteed to fight against volcanoes or at least predict their eruptions will be developed. People could live near volcanoes and not worry about the dangers of doing so.

# Eldfell Volcano Questions

1. The people of the town of Vestmannaeyja fought back against the volcanic eruption in 1973. Use the cause-and-effect chart to show how they reacted to the eruption.



2. What positive things were the people of the town able to use the remains of the volcanic eruption for?

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3. How long did the eruption and the pumping of water last? What can you infer about the effects of volcanic eruptions based on this time?

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4. Since people cannot fight back against volcanoes, what do they have to do when they erupt?

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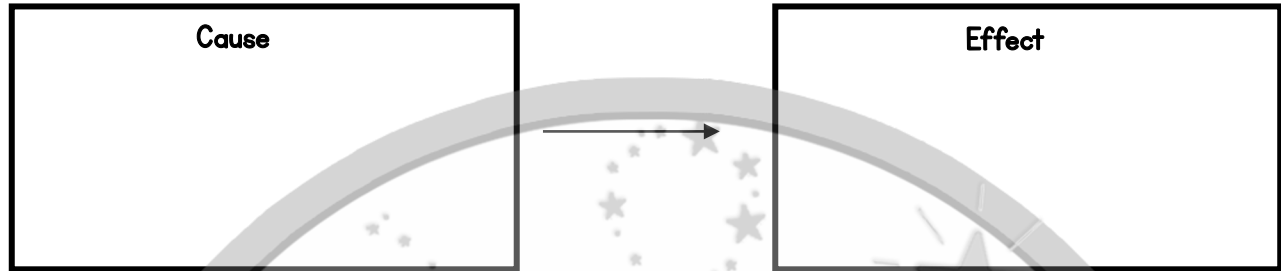
**Aerial view of Eldfell with the town and the ocean in view in the background.**

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## Beast Quake

What do football and earthquakes have in common? You might think the answer to that question is nothing. You'd be wrong. People cheering in the stands of a football stadium and earthquakes both have the ability to shake the ground. This was proven on January 8, 2011. A football player's actions on the field excited the fans so much that their movement was picked up by a **seismometer**. Seismometers are used to monitor earthquakes and volcanic activity.



**Marshawn Lynch running with the ball during his 67-yard touchdown.**

It was the fourth quarter of a game between the Seattle Seahawks and the New Orleans Saints. Seahawks running back Marshawn Lynch battled his way across the field. He made an amazing 67-yard touchdown. The crowd went wild in the stands. People

jumped and stomped together. This motion, happening all at the same time, shook the stadium and vibrated into the nearby soil.

A seismometer from the Pacific Northwest Seismic Network at the University of Washington was located right across the street from Qwest Field. This was the stadium where the Seahawks-Saints game took place. A spike in activity was recorded at the moment Marshawn Lynch broke free of the opposing team's players and scored a touchdown. The fans' movement during this event registered as a magnitude 1 or 2 earthquake. People *outside* of the stadium would have been able to feel the ground shaking as well. This event became known as "Beast Quake."

# SEISMOGRAPH

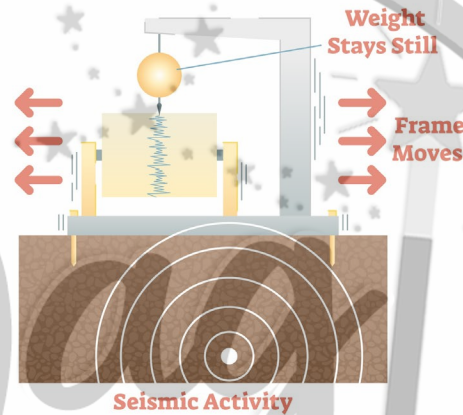
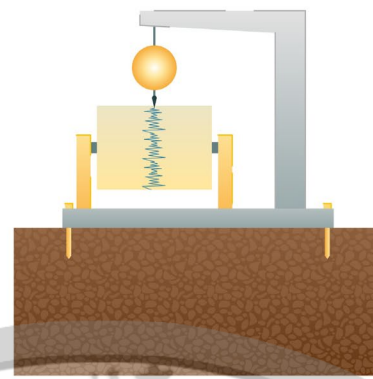
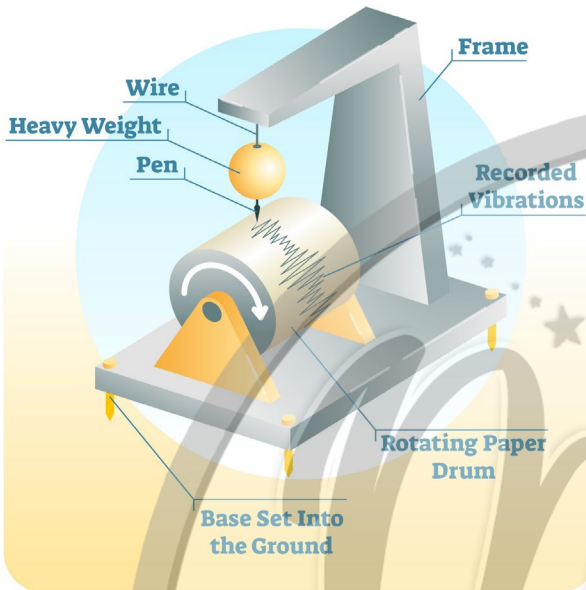


Diagram of how a seismograph works.

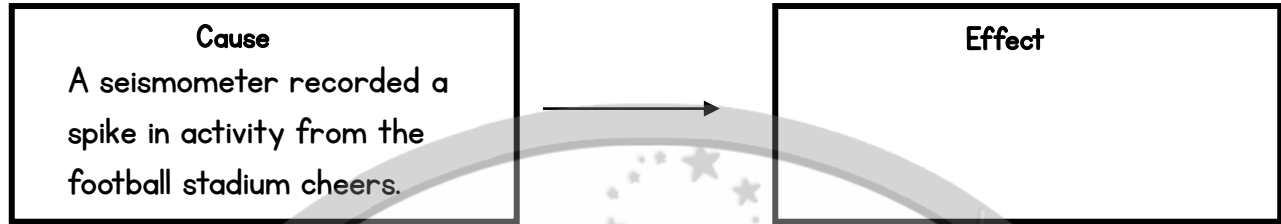
Beast Quake has been a wonderful event for scientists. They have been able to run tests of earthquake-measuring instruments. They hope to make earthquake-detecting equipment. The Seahawks allowed scientists from the Pacific

Northwest Seismic Network to put seismometers directly in their stadium. This meant more **data** could be collected from fan activity. A website showed the public live seismic readings from these seismometers.

The Beast Quake testing and data collection have led to some interesting developments. One invention is a system in California. It sends text alerts to residents who may be near an earthquake. A warning system like this can save lives. More study and improvements are needed. Someday, early-warning systems could be in place wherever earthquakes are common.

# Beast Quake Questions

1. Use the chart below to describe the effect Beast Quake has had on earthquake research.



2. Write a detail from the text that supports the following claim -  
*The crowd in the football stadium created an earthquake.*

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3. How has the studying of Beast Quake positively benefitted citizens of California?

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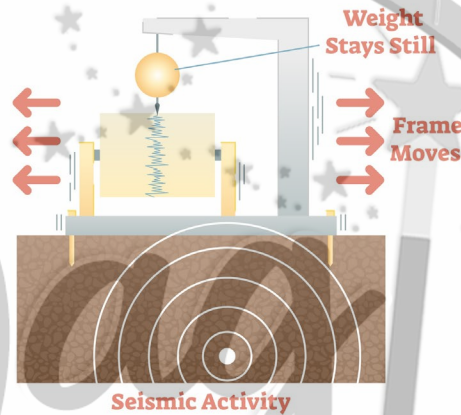
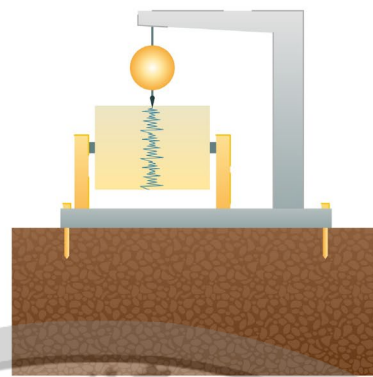
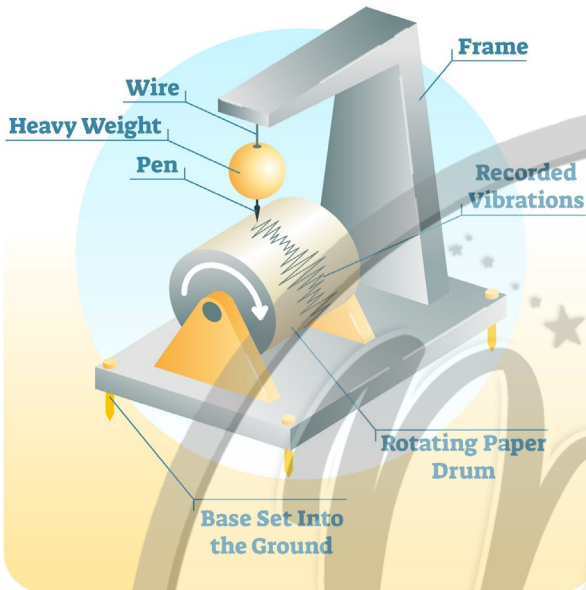


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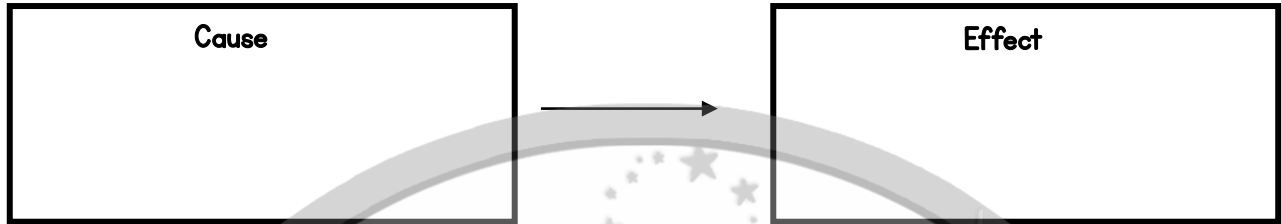
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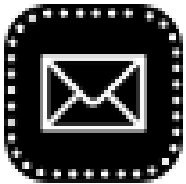
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