

JANUARY

Makugihon

FEBRUARY

Mahiguigmaon

MARCH

Matinabangon

APRIL

Matinahuron

MAY

Mahapsay og Malampyo

JUNE

*Maabtik og Musunod sa
Dihaklong Oras*

JULY

Maantigo og Maabilidad

AUGUST

*Maginhuhunahunon
para sa Urban*

SEPTEMBER

Madaginton

OCTOBER

Matinud-anon

NOVEMBER

Masaligan

DECEMBER

Maatampoon



Republic of the Philippines
Department of Education
Regional Office IX, Zamboanga Peninsula



Zest for Progress
Zeal of Partnership

Science

Quarter 4 - Module 1

The Effects of Earthquakes and Volcanic Eruptions



Name of Learner: _____

Grade & Section: _____

Name of School: _____



What I Need to Know

Look at your environment. Have you seen mountains, plains, volcanoes, and plateaus? Earth's surface is not flat. It has many shapes. Earth's landmasses are constantly changing and being reshaped.

In this module, you will learn about the internal forces that affect the changes of the earth and the different processes that constantly shape the earth.

This module is designed to help you master the concepts of earthquakes and volcanic eruptions. After going through this module, you are expected to:

- Describe the changes on the earth's surface as a result of earthquakes and volcanic eruptions (**S6ES-IVa-1**).



What's In

Activity 1. Try to Recall

Directions: Answer the following questions by putting a checkmark (√) on the appropriate box.

1. Have you experienced an earthquake or volcanic eruption?
 Yes No
2. How did you feel?
 excited nervous nothing at all
3. What can you observe after an earthquake or volcanic eruption?
 people are outside of their residences.
 people are celebrating.
 people are waiting for updates and warnings.



What's New

This activity will let you discover how earthquakes occur. Have fun!

Activity 2 Simulating an Earthquake

Problem: How do earthquakes occur?

What you need:

10 books Toy car One whole piece of cardboard
Small toy house or small medicine box
Tree twigs standing on a piece of clay
Popsicle sticks, each stick standing on a piece of clay to represent electric posts

What you need to do:

1. Make two piles out of 10 books. These books will represent the layers of bedrock on the earth's crust.
2. Put the cardboard on top of the books.
3. Arrange the toy car, Popsicle sticks, toy house, and the twigs on the cardboard.
4. Slowly remove one book at the bottom of one pile. Observe what happens.

What have you found out:

1. What happened to the books on the pile when the book at the bottom was removed? _____
2. What do the spaces between the books in the pile represent?

3. What happened to the objects on the cardboard when the book was removed? _____
4. Compare the activity to an earthquake.

Conclusion:

Make a conclusion based from the given problem.



What Is It

Earth's crust is made up of continents and oceans. Its continental and oceanic parts are composed of several large and small moving rock layers called **crustal plates**. The movement of a plate on the crust is often accompanied by earthquakes or volcanic eruptions.

An **earthquake** is the shaking of the earth's crust caused by the sudden release of energy in the rocks underground. There are two types of earthquakes--- tectonic and volcanic. **Tectonic earthquakes** are caused by the movement of Earth's crust. Meanwhile, **volcanic earthquakes** are caused by the movement of magma inside a volcano. **Magma** is the molten rock material within Earth.

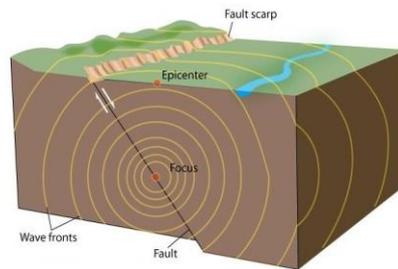
An earthquake generates **seismic waves** or vibrations that travel through Earth. **Seismologists** are people who study seismic waves to determine the epicenter of an earthquake. They use an instrument called a **seismograph** to record seismic waves.

Look at the parts of an earthquake here. The point within Earth where an earthquake comes from. It is the place where the earthquake originates is called the **focus**. The **epicenter** is the area on Earth's surface directly above the focus.

The **Philippine Institute of Volcanology and Seismology (PHIVOLCS)** is the agency that monitors, predicts, and determines areas that are prone to earthquakes, volcanic eruptions, tsunamis, and other related hazards. PHIVOLCS records over five earthquakes a day, with more than 10 of those with felt intensity each year.

Magnitude refers to the amount of energy released by an earthquake. **Intensity** refers to the effect of an earthquake, especially the damages. **Richter Magnitude Scale** is used to describe the strength of an earthquake based on the height of the wave measured in the seismograph, created by American seismologist, **Charles F. Richter** in 1935.

Seismic waves radiate from the focus of an earthquake



<https://bit.ly/3tw98zm>

Magnitude Scale

Magnitude Scale	Description
1	Not felt on the surface, only detectable when an ultra-sensitive seismometer is operated under favorable conditions
2	Hardly perceptible shocks and maybe felt only slightly near the epicenter.
3	Very feeble shocks and only felt near the epicenter but causing little or no damage
4	Feeble shocks, but causing little or no damage.
5	Moderate quake felt over wide areas, can cause local damages near the epicenter.
6	Strong earthquake felt over a wide area near the epicenter, damage to poorly constructed building within 10km
7	A major earthquake and can cause serious damage and possible loss of life near the epicenter; Can generate tsunamis when they occur under the sea.
8	A great earthquake, which can cause destruction, loss of life over several 100km from the epicenter. When they occur under the sea, considerable tsunamis are produced.

9	A rare great earthquake, major damage, and loss of life over a large region even more than 1000km from the epicenter.
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Source: http://www.phivolcs.gov.ph/index.php?option=com_content&view=article&id=49:richter-magnitude-scale&catid=56

Modified Mercalli Scale measured the shaking based on the observation of damage brought by an earthquake in a particular place or location, invented by an Italian scientist, **Giuseppe Mercalli** in 1902.

Modified Mercalli Scale

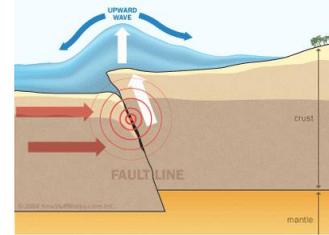
Number	Name	Description
I	Instrumental	Detected by a seismograph, usually not felt
II	Feeble	Noticed only by people at rest
III	Slight	Shaking felt indoors but not in outdoors; hanging objects swing back and forth
IV	Moderate	Generally perceptible by people in motion; hanging objects swing
V	Rather Strong	Almost everyone feels movement. Sleeping people are awakened. Doors swing open or closed; dishes are broken. Cracked walls; trees disturbed
VI	Strong	Felt by all. Slight damage occurs. Strong shaking can cause people to fall over and walls and ceilings to crack. People walk unsteadily; windows break.
VII	Very Strong	Everyone runs outdoors. Poorly built buildings suffer severe damage. Difficult to stand; plaster, bricks, and tiles fall; large bells ring. Drivers feel their car shaking. People fall over.
VIII	Destructive	Tall buildings sway. Minor damage to specially designed buildings; chimneys and walls collapse. Drivers have trouble steering. Houses that are not bolted down might shift on their foundations. Tree branches break.
IX	Ruinous	Ground cracks; well-constructed buildings damaged; pipes broke. All buildings suffer major damage. General panic; damage to foundations; sand and mud bubble from ground.
X	Disastrous	Landslides occur, ground cracks widely. Major damage; most buildings and their foundations are destroyed. Some bridges are destroyed.
XI	Very Disastrous	Bridges and buildings destroyed, large fissures open. Almost all structures fall. Very wide cracks on the ground; railway tracks bend; roads break up.
XII	Catastrophic	Total destruction; ground surface waves seen; river courses altered

Source: "Greenfieldgeography-Measuring Disasters"

<http://greenfieldgeography.wikispaces.com/Measuring+Disasters>

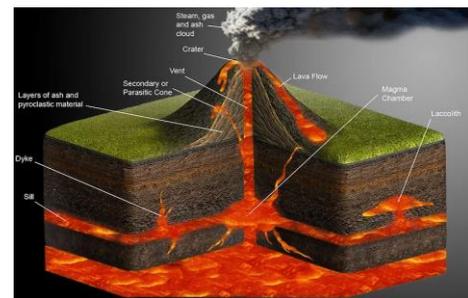
Effects of an Earthquake

1. **Destruction of Property and Loss of Lives** - ground ruptures can destroy any structure in the area such as houses, buildings, dams, bridges, roads and also cause the loss of people's lives.
2. **Landslide** - ground shaking loosens rocks and soil, which causes the rocks and soil to slide and bury areas below the mountains.
3. **Fire** - can happen during an earthquake when electric power and gas lines break.
4. **Tsunami** - is a huge underwater wave produced when an earthquake occurs under the sea. A tsunami is formed when rocks along with a fault slip.



<https://bit.ly/3o00YPm>

A **volcano** is an opening of Earth's crust where *lava*, *pyroclasts*, and *gases* are ejected onto the surface during eruptions. The most prominent part of the volcano is the cone, formed by the mountainous accumulation of volcanic materials. The other parts are the **crater**, which is a steep-walled depression at the peak of the volcano, and the volcanic vent, a cylindrical channel that connects the crater or mouth to the magma chamber. Some volcanoes have large craters called **calderas** that can exceed about 1km in diameter. **Calderas** are formed when the summit of the volcano collapses during violent or explosive eruptions. Mt. Mayon, Mt. Taal, and Mt. Pinatubo are examples of active volcanoes in the Philippines. The volcanoes above sea level are the most popular, but the vast majority of the world's volcanoes lie beneath the sea formed along the global oceanic ridge.

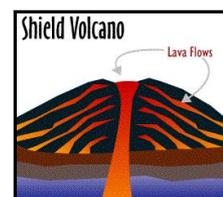
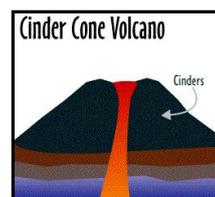
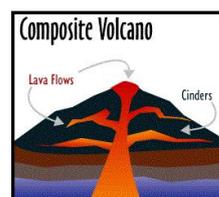


<https://bit.ly/3rrFIgb>

Kinds of Volcanoes

A. According to Shape and Composition of the Cone

1. **Shield Volcano** has a wide base with gentle sloping sides. The cone is made up purely of lava that has poured out and solidified during a mild or quiet eruption.



<https://bit.ly/3axujlw>

2. **Cinder Cone Volcano** is built almost entirely of loose fragments called *cinders* (pyroclasts and tephra) a cinder cone volcano is formed by explosive eruptions. Explosive eruptions eject lava and rocks into the air. The lava fragments

solidarity into small pieces of pyroclasts called *tephra*. Cinder has a narrow base and a very steep slope.

3. Composite Volcano or Stratovolcano are composed of alternating layers of lava and cinders (pyroclasts). They are formed when volcanic eruptions vary between quiet and violent or explosive.

B. According to Activity

1. Active Volcano is considered active if it is currently erupting or showing regular signs of activity like earthquake activities and significant gas emissions. An active volcano has a record of eruption within 50 years.

2. Inactive Volcano

Dormant Volcanoes are those that have currently erupted and then have entered a long period of inactivity. Seismologists have found out that the longer period of dormancy or inactivity between volcanic eruptions the greater the chance of having a very explosive eruption in the future. **Extinct Volcanoes** are those that have not shown signs of activity for a long period. It has no record of volcanic eruptions in the past thousand years. Whether the volcanic is truly extinct is often difficult to determine.

Types of Volcanic Eruption

Explosive or Violent Eruption during an explosive eruption, the lava ejected is torn into shreds, forming pieces of pyroclastic materials called *tephra*. Explosive eruptions can eject a large number of materials into the air. Very violent explosive eruptions are called *Plinian* eruptions, after the Roman naturalist Pliny the elder. These eruptions can last for several hours to days, ejecting large amounts of pyroclastic materials. **Quiet Non-explosive Eruption** basaltic magma has relatively low silica content. It is less viscous and gases can escape readily from it. As a result, the volcanic eruption is mild and a gentle flow of lava follows.

Benefits of Volcanic Eruption	Dangers of Volcanic Eruption <i>Volcanic eruptions also pose hazards to people and property</i>
1. Agricultural Benefits 2. Energy Benefits 3. Industrial Benefits 4. Economic and Recreational Benefits	1. Effects of Volcanic Gases 2. Effects of Lava Flows 3. Effects of Pyroclastic Flows 4. Effects of Volcanic Activities in the Global Climate



What's More

Activity 3.

A. Sentence Completion. Supply the missing terms to complete the sentence. Choose your answer from the box below.

Volcanic Earthquake	Richter Magnitude	Intensity
Earthquake	Magnitude	

1. The total amount of energy released by an earthquake is called _____.
2. The shaking of the ground that happens when crustal plates move is called _____.
3. The shaking of the ground that happens when there is a strong volcanic eruption is called _____.
4. Used to describe the strength of an earthquake based on height of the wave measured in the seismograph is known as _____.
5. The measure of how much damage an earthquake causes the surface is called _____.

B. True or False. Write **True** if the statement is correct; otherwise, write **False**.

- _____ 1. A cinder cone volcano is formed by explosive eruptions.
- _____ 2. A volcanic eruption can be predicted.
- _____ 3. A volcano is considered active if it has no signs of activity.
- _____ 4. All volcanoes emit the same kind of pyroclastic materials.
- _____ 5. Mudflows occur when rainfalls and mix with ashes and debris.



What I Have Learned

Activity 4. Fill Me In.

Directions: Complete the statement below.

Earthquake	Volcanic earthquake	gases	two
eruptions	lava	Volcanic	Tectonic earthquake
Volcano	pyroclasts		

I learned that....

The (1) _____ is a sudden movement or vibration in the earth's crust. There are (2) _____ types of Earthquake. (3) _____ it is caused by the movement of Earth crust or crustal plates and (4) _____ is the

shaking of grounds that happen when there is a strong(5)
_____ eruption.

A (6)_____ is an opening of Earth's crust where
(7)_____,(8)_____, and (9) _____ are ejected onto the surface
during (10)_____.



What I Can Do

Activity 5. Match Me

Directions: Match the descriptions in column A to the terms in column B.

A

1. An earthquake occurs under the sea.
2. An American seismologist created the Richter Magnitude Scale in 1935.
3. Point or line on the earth's surface directly move it.
4. A government agency concern with earthquake and volcanic eruption of the Philippines.
5. Areas where two plates meet, they interact in several ways it collides, separates, or slides.
6. It is the place where the earthquake originates
7. Causes the rocks and soil to slide and bury areas below the mountains.
8. A volcano that has a wide base with gentle sloping slides.
9. It has no record of volcanic eruptions in the past thousand years.
10. Molten rocks that flow on the surface of a volcano.

B

- A. Charles F. Richter
- B. Epicenter
- C. Extinct Volcano
- D. Focus
- E. Landslide
- F. Lava
- G. PHIVOLCS
- H. Plate Boundaries
- I. Shield Volcano
- J. Tsunami



Assessment

A. Directions: Encircle the letter of the best answer.

1. When does a volcanic earthquake occur?
A. When there is a big landslide C. When volcanoes erupt
B. When the Earth's crust moves D. When huge animals move
2. If the lava is very thick, the volcano would erupt
A. silently C. cannot be determined
B. violently D. slowly
3. All of the following explain earthquake EXCEPT
A. The movement may be horizontal, diagonal, or vertical along a huge crack.
B. The vibrations are most strongly felt at the epicenter and gradually diminish as they spread out

- C. It is a sudden trembling or shaking of the ground.
D. It is predictable
4. What is earthquake intensity?
A. a measure of seismic risk C. a measure of an earthquake focus
B. a measure of the energy released D. a measure of the damage done
5. Which of the following is formed when the top of a volcano collapses into a partially emptied magma chamber?
A. crater B. caldera C. fissure D. volcanic rock
6. When does a tsunami occur?
A. When an earthquake is strong
B. When an earthquake is weak
C. When an earthquake occurs on the ocean floor
D. When an earthquake occurs on land
7. What do you call an instrument used to measure the earthquake's magnitude?
A. Stethoscope B. Seismograph C. Thermometer D. Barometer
8. What do you call a person who studies earthquakes?
A. Geographer B. Seismologist C. Geologist D. Seismographer
9. What does PHIVOLCS mean?
A. Philippine Institute of Volcanologist and Seismologist
B. Philippine Institute of Volcanology and Seismonology
C. Philippine Institute of Volcanology
D. Philippine Institute of Volcanologist
10. Which of the following is NOT an effect of the earthquake?
A. Tsunami C. Drying of crops
B. Landslide D. Building destruction

B. Directions: Write **TRUE** if the statement is correct; otherwise, write **FALSE**.

- _____ 1. Magma is the molten rock underground.
- _____ 2. People and the environment benefit from volcanic eruptions.
- _____ 3. A dormant volcano stays dormant forever.
- _____ 4. A crater is a steep-walled depression at the peak of the volcano.
- _____ 5. Volcanic eruptions pose hazards to people.
- _____ 6. Lava is the molten rock that has reached Earth's surface.
- _____ 7. A volcanic eruption is more predictable than an earthquake because some signs occur before the event.
- _____ 8. Lahar is a volcanic mudflow.
- _____ 9. The epicenter is the line on the earth's surface directly above the focus of an Earthquake.
- _____ 10. Earthquake is the shaking of the ground. It happens when crustal plates move.



Additional Activity

Differentiate Tectonic Earthquakes from Volcanic Earthquakes.

Answer Key:

Additional Activity

Tectonic earthquakes are caused by the movement of Earth's crust while volcanic earthquakes are caused by the movement of magma inside a volcano

<p style="text-align: center;">What's New</p> <p style="text-align: center;">Activity 2</p> <p>What have you found out:</p> <ol style="list-style-type: none"> 1. Volcano with liquid and sand in it. 2. The sticky the materials inside the volcano, the slower it flows 3. Quiet eruption 4. Explosive eruption <p style="text-align: center;">Conclusion: Answers may vary</p>	<p style="text-align: center;">Post Assessment</p> <p>A.</p> <ol style="list-style-type: none"> 1. c 2. b 3. d 4. d 5. b 6. c 7. b 8. b 9. b 10. c <p>B.</p> <ol style="list-style-type: none"> 1. True 2. True 3. False 4. True 5. True 6. True 7. True 8. True 9. True 10. True
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<p style="text-align: center;">What's New</p> <p style="text-align: center;">Activity 1</p> <p>What have you found out:</p> <ol style="list-style-type: none"> 1. The books were moved 2. Faults or the plate boundaries 3. The objects were also moved 4. The activity is like an earthquake because when the books were moved, the objects above it moved too. It is similar to tectonic plates. When they move an earthquake occurs and the structures on the ground move. <p style="text-align: center;">Conclusion: Answers may vary</p>	<p style="text-align: center;">What I Have Learned</p> <ol style="list-style-type: none"> 1. Earthquake 2. two 3. Tectonic earthquake 4. Volcanic earthquake 5. Volcanic earthquake 6. Volcano 7. lava 8. pyroclasts 9. gases 10. eruptions 	<p style="text-align: center;">What I Can Do</p> <ol style="list-style-type: none"> 1. J 2. A 3. B 4. G 5. H 6. D 7. E 8. I 9. C 10. F
--	--	---

What I Know

A.

1. Earthquake
2. Tectonic Earthquake
3. Focus
4. Epicenter
5. Volcanic Earthquake

B.

1. VOLCANO
2. LAVA
3. LAHAR
4. MAGMA
5. CRATER

References

Books

Thaddeus Owen D. Ayuste; Janalin Fae T. Romblon; Antonio V. Coloma; Ms. Krisette B. Remigio; Ivy P. Mejia and Marina E. Balce, Copyright 2018, Science in Action 6, Diwa textbook K to 12 Curriculum Compliant, **ISBN 978-971-46-1226-6 RS-URW-MB15**

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http://www.phivolcs.gov.ph/index.php?option=com_content&view=article&id=49:richter-magnitude-scale&catid=56

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DEVELOPMENT TEAM

Writer: Julie Yosoya Ekstrom

Teacher III
Sta. Lucia Central ES

Editor: Leonor T. Tabalbag

Teacher I
Napolan NHS

Reviewer: MILA P. ARAO

EPS - Science

Management Team:

DANNY B. CORDOVA, EdD, CESO VI
Schools Division Superintendent

MA. COLLEN L. EMORICHA, EdD., CESE
Assistant Schools Division
Superintendent

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CID Chief

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EPS-LRMDS
MILA P. ARAO
EPS-Science

Region IX Hymn

OUR EDEN LAND

Here the trees and
flowers bloom,
Here the breezes
gently blow,
Here the birds sing
merrily,
And liberty forever
stays,

Here the Badjaos
swam the seas,
Here the Samals live in
peace,
Here the Tausogs
thrive so free,
With the Yakans in
unity.

Gallant men
And Ladies fair,
Linger with love and
care,

Golden beams of
sunrise and sunset,
Are visions you'll never
forget.
Oh! That's Region IX...

Hardworking people
abound,
Every valley and dale
Zamboangenos,
Tagalogs, Bicolanos,
Cebuanos, Ilocanos,
Subanens, Boholanos,
Ilongos,
All of them are proud
and true
Region IX our Eden
Land.

Region IX, our Eden
Land.

Footprints

One night I dreamed a dream,
I was walking along the beach with my Lord.
Across the dark sky flashed scenes from my life.
For each scene, I noticed two sets of footprints in the sand,
one belonging to me and one to my Lord.

When the last scene of my life shot before me,
I looked back at the footprints in the sand.
There was only one set of footprints.
I realized that this was at the lowest
and saddest times of my life.
This always bothered me
and I questioned the Lord about my dilemma.

"Lord, You told me when I decided to follow You,
You would walk and talk with me all the way.
But I'm aware that during the most troublesome times of my life,
there is only one set of footprints.
I just don't understand why, when I need You most,
You leave me."

He whispered, "My precious child, I love you
and will never leave you, never, ever,
during your trials and testings.
When you saw only one set of footprints,
It was then that I carried you."

Margaret Fishback Powers