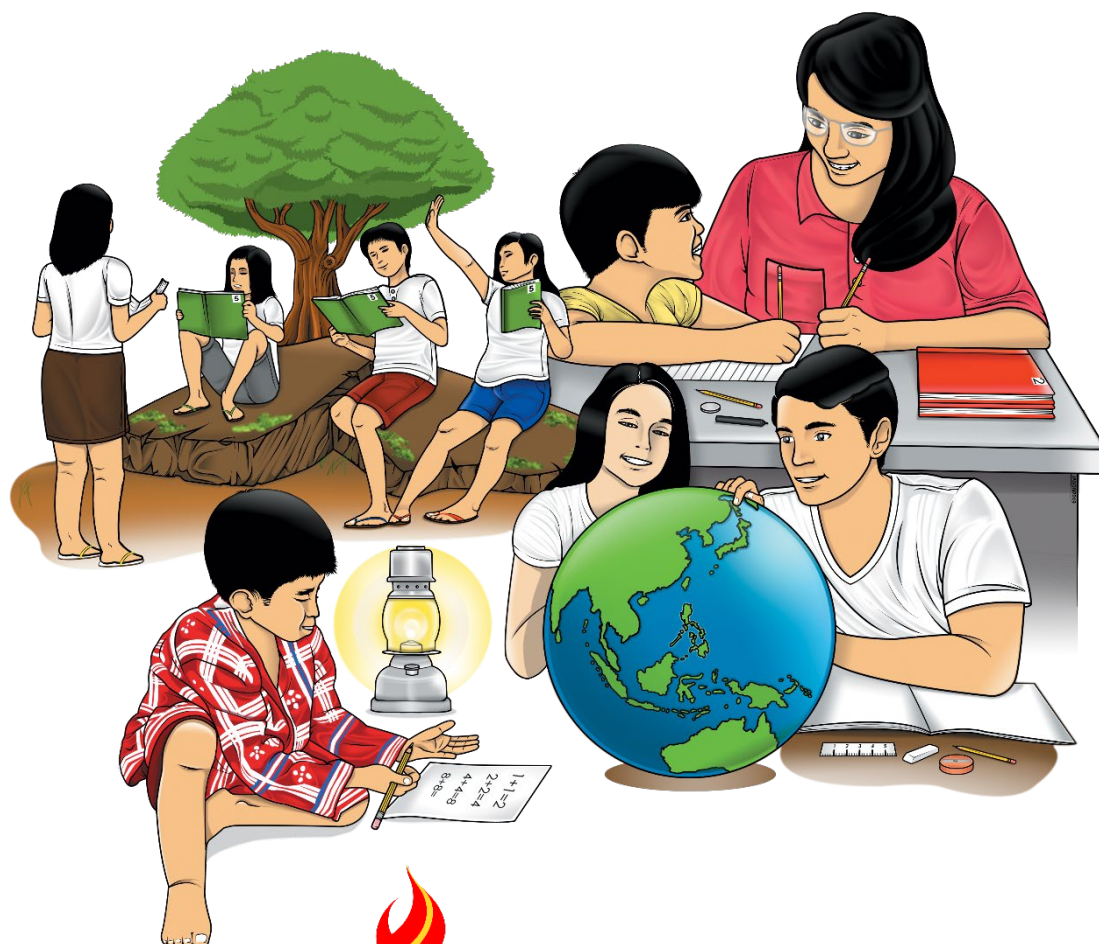


Earth and Life Science

Quarter 1 – Module 16:

Geologic Processes and Hazards



Earth and Life Science
Alternative Delivery Mode
Quarter 1 – Module 16: Geologic Processes and Hazards
First Edition, 2021

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Published by the Department of Education
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Undersecretary: Diosdado M. San Antonio

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Printed in the Philippines by _____

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Senior High School

Earth and Life Science

Quarter 1 – Module 16:

Geologic Processes and Hazards

Introductory Message

This Self-Learning Module (SLM) is prepared so that you, our dear learners, can continue your studies and learn while at home. Activities, questions, directions, exercises, and discussions are carefully stated for you to understand each lesson.

Each SLM is composed of different parts. Each part shall guide you step-by-step as you discover and understand the lesson prepared for you.

Pre-tests are provided to measure your prior knowledge on lessons in each SLM. This will tell you if you need to proceed on completing this module or if you need to ask your facilitator or your teacher's assistance for better understanding of the lesson. At the end of each module, you need to answer the post-test to self-check your learning. Answer keys are provided for each activity and test. We trust that you will be honest in using these.

In addition to the material in the main text, Notes to the Teacher are also provided to our facilitators and parents for strategies and reminders on how they can best help you on your home-based learning.

Please use this module with care. Do not put unnecessary marks on any part of this SLM. Use a separate sheet of paper in answering the exercises and tests. And read the instructions carefully before performing each task.

If you have any questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

Thank you.



What I Need to Know

This module was designed and written with you in mind. It is here to help you master the nature of Earth and Life Science. The scope of this module permits it to be used in many different learning situations. The language used recognizes the diverse vocabulary level of students. The lessons are arranged to follow the standard sequence of the course. But the order in which you read them can be changed to correspond with the textbook you are now using.

The module has one lesson:

- Lesson 2 – Geological Processes and Hazards

After going through this module, you are expected to:

1. identify places in the Philippines that are prone to geologic hazards like earthquakes, volcanic eruptions, and landslides using hazard map; and
2. explain why it is important to identify places that are prone to geologic hazards.



What I Know

Directions. Read the following questions and choose the letter of the best answer. Write the chosen letter on a separate sheet of paper.

1. Which of the following is an example of a geologic hazard?
 - A. earthquakes
 - B. flood
 - C. tornado
 - D. tropical cyclone
2. Where can you find the Pacific Ring of Fire?
 - A. Arctic Ocean
 - B. Atlantic Ocean
 - C. Indian Ocean
 - D. Pacific Ocean
3. What do you call the point of origin of an earthquake located just above the focus?
 - A. convergent
 - B. divergent
 - C. epicenter
 - D. transform
4. Which type of map shows the risk of a particular area to a certain threat?
 - A. hazard
 - B. physical
 - C. resource
 - D. topographic
5. What type of hazard is climate and weather related?
 - A. anthropogenic
 - B. biological
 - C. ergonomic
 - D. natural
6. What refers to the movement of rock, debris, and soil down a slope?
 - A. landslide
 - B. tsunami
 - C. typhoon
 - D. volcanic eruption

7. Which of the following geologic features makes the provinces of La Union and Pangasinan high risk to earthquakes?
- A. Iba Fault
 - B. Lianga Fault
 - C. Manila Trench
 - D. Tablas Fault
8. Which of the following is responsible for plate movement?
- A. gravitational force
 - B. radiation emitted by the Sun
 - C. convection current in mantle
 - D. attraction from the moon
9. Which of the following is NOT a geologic hazard?
- A. earthquakes
 - B. landslides
 - C. typhoon
 - D. volcanic eruptions
10. Which of the following areas is the LEAST prone to earthquakes?
- A. Cavite
 - B. Ifugao
 - C. La Union
 - D. Tarlac
11. Which of the following areas has the HIGHEST risk of volcanic-related disaster?
- A. Albay
 - B. Bataan
 - C. Biliran
 - D. Sulu
12. Which of the following areas is LEAST at risk of landslide?
- A. Batangas
 - B. Cebu
 - C. La Union
 - D. Manila
13. Which of the following is an example of natural hazard?
- A. climate change
 - B. deforestation
 - C. landslide
 - D. mining

14. Which of the following factors makes the province of Benguet at risk of an earthquake?
- A. bodies of water around
 - B. high population
 - C. presence of trees
 - D. topography and mountains
15. Why do you think the Visayas islands are NOT at risk to earthquakes?
- A. lack of fault lines
 - B. lack of mountains
 - C. the presence of islands
 - D. the presence of plains

Lesson 2

Geological Processes and Hazards

The Philippines is an archipelago that is made up of 7641 islands and home to world-renown natural wonders and pristine water bodies. The country is in a unique location because it rests in the Pacific Typhoon Belt and Pacific's earthquake and volcano Ring of Fire. The Ring of Fire is a home to over 75% of the world's active and dormant volcanoes. Because of its geographic location, the Philippines is among the greatest hazard and disaster-prone countries in the world.



What's In

The Philippines is no stranger to natural hazards. Every year, thousands to millions of Filipinos are extremely affected by all forms of hazards such as earthquakes, typhoons, and volcanic eruptions. These natural hazards may result in multiple disasters.

Activity 1: Cause and Effect

Directions. Supply the blank boxes with the causes and effects from the given geologic hazards.

<i>Geologic Hazard</i>	<i>Causes</i>	<i>Effects</i>
Volcanic Eruptions		
Landslides		
Earthquakes		



What's New

Geologic Process

Geological processes can be described as natural forces that shape the physical makeup of a planet. These forces cause movements of plates in the Earth's crust, the area where humankind lives. As these processes occur from time to time, it poses a continuous source of hazards to people, community and society.

Hazards

A hazard is a phenomenon caused by natural or human forces which poses threat to humans, animals, properties and environment. For instance, since the Philippines is located within the Ring of Fire, the country experiences many earthquakes and volcanic eruptions compared to other countries. This makes the country one of the most hazard-prone countries in the world.

Hazards can be classified as either natural or anthropogenic.

Natural: Earthquakes, volcanic eruptions, landslides and tsunamis (*climate and weather-related hazards*)

Anthropogenic: Deforestation, mining and climate change (*man-made*)

Hazard Map

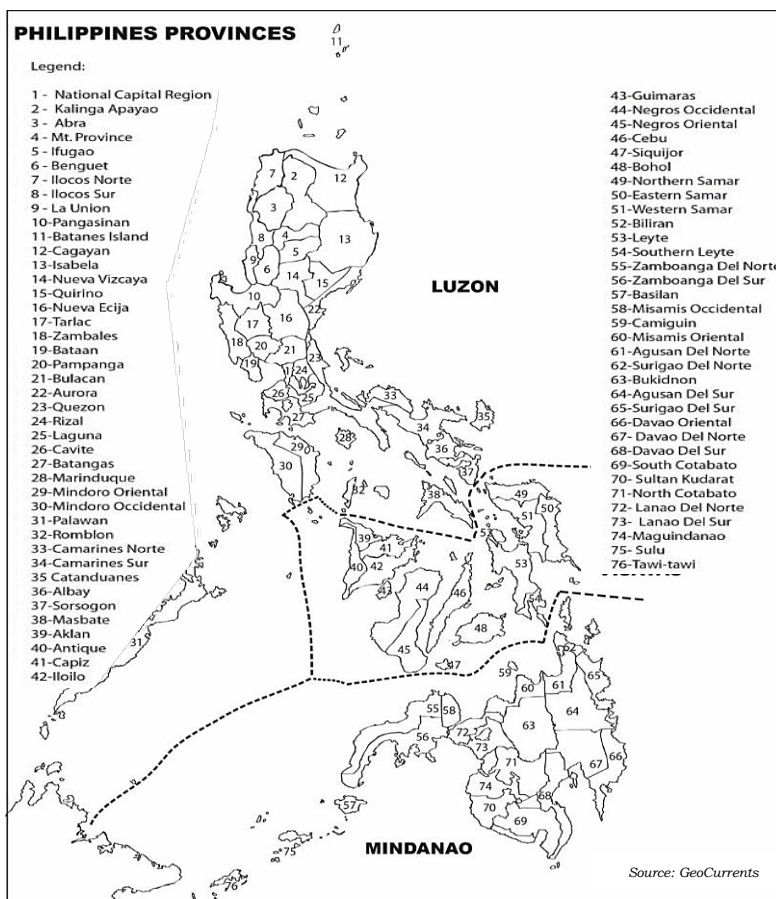
It is a map that illustrates the areas that are exposed or prone to a particular hazard. They are used for natural hazards such as landslides, flooding, volcanic eruption and tsunami. It is also used to mitigate the potential negative effects of these hazards

Activity 2: Point me

Every year, dozens of natural disasters strike our country. Some are just passing by and some even make history because of massive destruction.

Directions. Since disasters are all over the news, what places do you think have been affected by geologic hazards for the past decade? Use the Philippine map on the right side. Write your answers on the box below.

Earthquakes
1.
2.
Volcanic Eruptions
1.
2.
Landslides
1.
2.





What is It

Now, you have learned that geologic location is the major reason why the Philippines is a hazard-prone country. The Philippine government partnered with other private institutions to reduce the risk of hazards through producing hazard maps that are publicly available. For example, the partnership of news networks with the Philippine Institute of Volcanology and Seismology (PHIVOLCS). This partnership shares valuable and scientific information which increases the public's understanding on geologic hazards and risks associated with it.

Another is Manila Observatory, a private non-stock and non-profit research institution with the help of the Department of Environment and Natural Resources (DENR). This partnership produced hazard maps that show the vulnerability of the country to environmental disasters.

Geophysical map

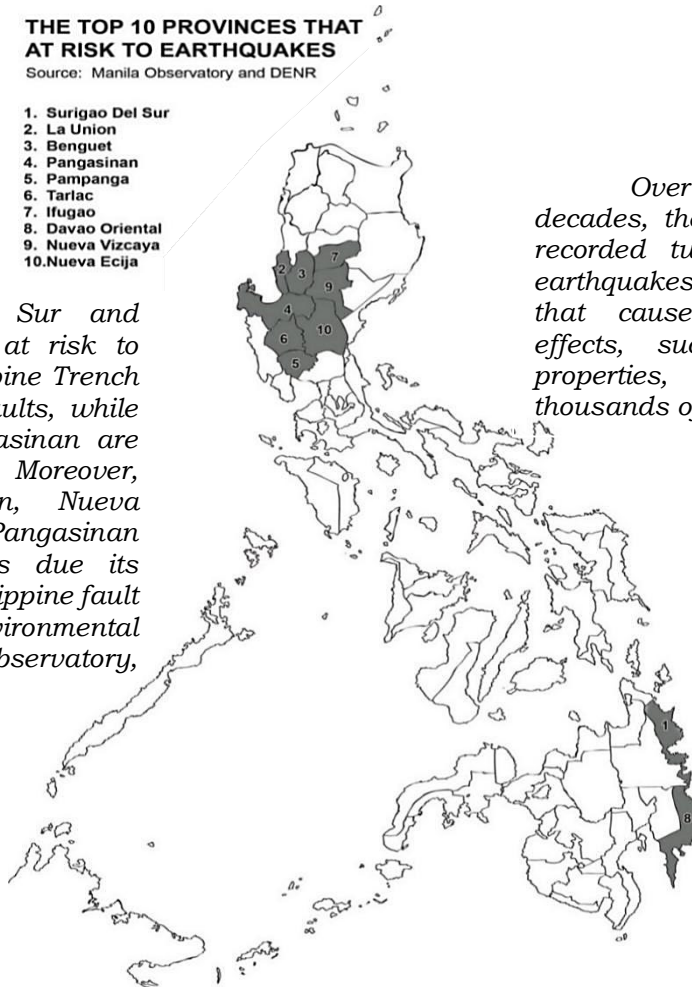
THE TOP 10 PROVINCES THAT AT RISK TO EARTHQUAKES

Source: Manila Observatory and DENR

1. Surigao Del Sur
2. La Union
3. Benguet
4. Pangasinan
5. Pampanga
6. Tarlac
7. Ifugao
8. Davao Oriental
9. Nueva Vizcaya
10. Nueva Ecija

Surigao Del Sur and Davao Oriental are at risk to hazard due to Philippine Trench and nearby active faults, while La Union and Pangasinan are due Manila Trench. Moreover, Benguet, La Union, Nueva Vizcaya, Eastern Pangasinan and Nueva Ecija is due its location along the Philippine fault Zone. (Center for Environmental Geomatics- Manila Observatory, 2005)

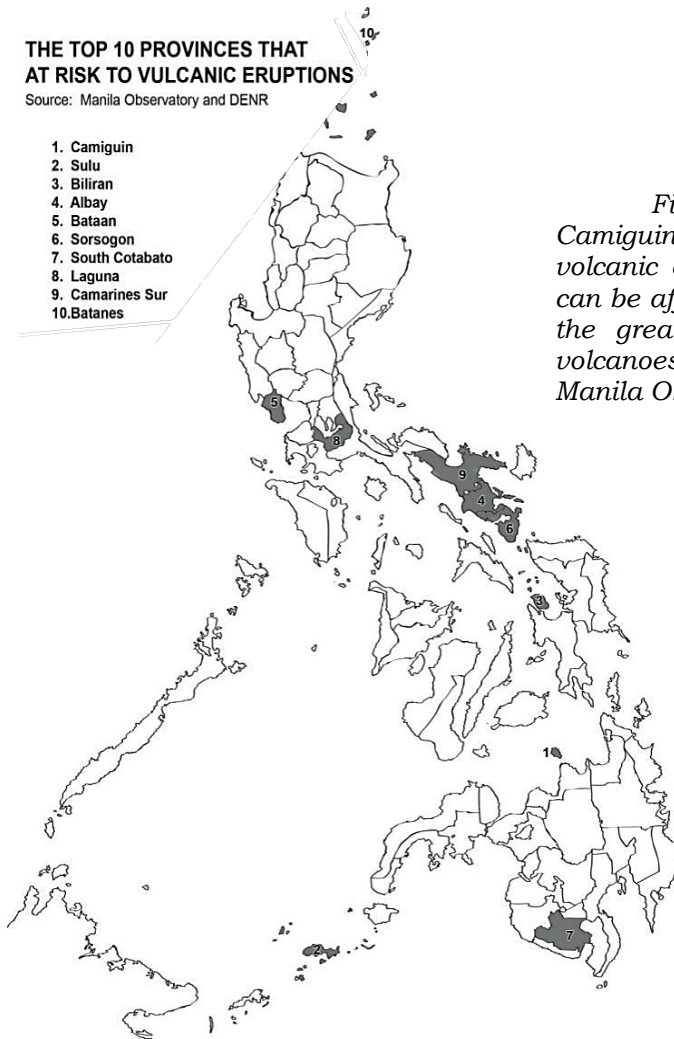
Over the past decades, the PHILVOCS has recorded twelve destructive earthquakes in the Philippines that caused unimaginable effects, such as loss of properties, injuries, and thousands of deaths.



THE TOP 10 PROVINCES THAT AT RISK TO VULCANIC ERUPTIONS

Source: Manila Observatory and DENR

1. Camiguin
2. Sulu
3. Biliran
4. Albay
5. Bataan
6. Sorsogon
7. South Cotabato
8. Laguna
9. Camarines Sur
10. Batanes

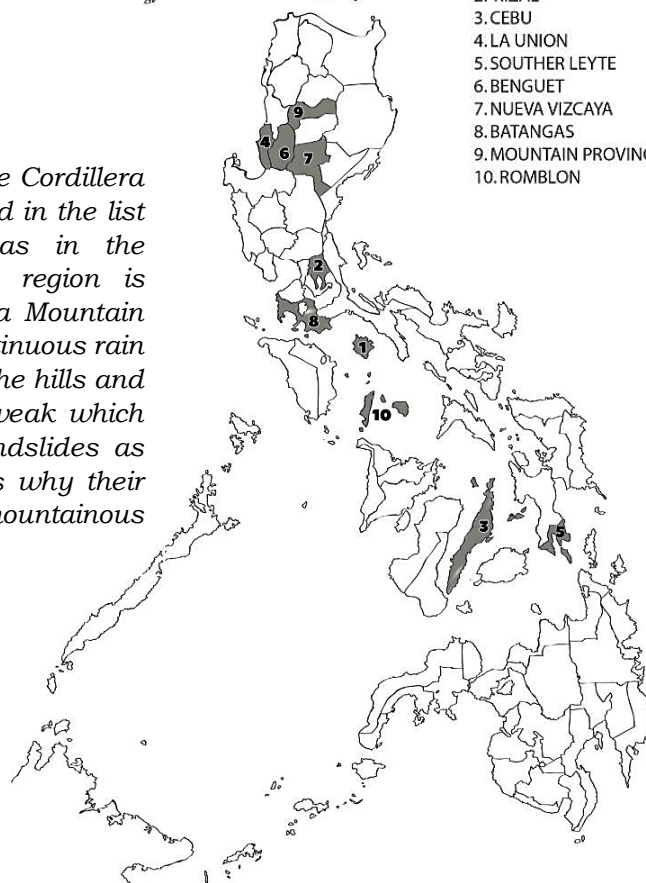


First on the rank with the highest risk is Camiguin because the land area was so small. If volcanic eruption may occur, the whole province can be affected. Sulu ranks second because it has the greatest number of active and dangerous volcanoes. (Center for Environmental Geomatics-Manila Observatory, 2005)

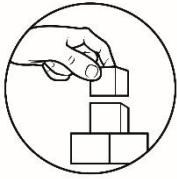
TOP 10 MOST LANDSLIDE PRONE PROVINCES OF THE PHILIPPINES

Data Source: Department of Environment and Natural Resources

1. MARINDUQUE
2. RIZAL
3. CEBU
4. LA UNION
5. SOUTHER LEYTE
6. BENGUET
7. NUEVA VIZCAYA
8. BATANGAS
9. MOUNTAIN PROVINCE
10. ROMBLON



Most of the provinces in the Cordillera Administrative Region are included in the list of top 10 landslide-prone areas in the Philippines. Because the entire region is situated in and around Cordillera Mountain ranges. So, after massive and continuous rain or earthquakes, certain areas on the hills and mountains become delicate and weak which makes the region exposed to landslides as well as to other provinces that is why their area is classified as rugged and mountainous with prominent flat lands.



What's More

Activity 3: Identify me

Directions. Using the hazard map found on the previous pages, answer the following questions.

1. Identify the top 3 places in the Philippines that are hazard-prone to volcanic eruptions, earthquakes, and landslides. Justify your answers why they are most prone.
2. What is the importance of using a hazard map?

Refer to scoring rubrics for short answer question.

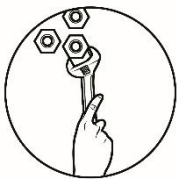


What I Have Learned

Activity 4: Complete me

Directions. Read the following statements and complete them by filling in with the correct term and/or phrase.

1. The Philippines experiences more earthquakes and volcanic eruptions because it is located in the _____.
2. Earthquakes and volcanic eruptions are known as _____ type of hazards.
3. Surigao Del Sur and Davao Del Norte are at risk of hazard due to _____ and _____.
4. Camiguin has the highest risk of effects of a volcanic eruption because the land area is too _____.
5. Man-made hazards are classified as _____.



What I Can Do

Activity 5: Hazard identification

Directions. Identify hazardous places during or after earthquakes in the following locations.

1. Home
2. Classroom and school building
3. Community (e.g. barangay, municipality or provinces)

The answer must be something similar to this:

In the community: Damaged roads and bridges.

Refer to scoring rubrics for short answer question.

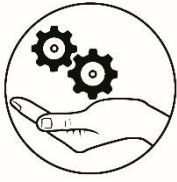


Assessment

Directions. Read the following questions and choose the letter of the correct answer. Write the chosen letter on a separate sheet of paper.

1. Which of the following is an example geologic hazard?
 - A. earthquakes
 - B. climate change
 - C. deforestation
 - D. mining
2. Which of the following maps is used to identify a place that is prone to disaster?
 - A. hazard
 - B. physical
 - C. resource
 - D. topographic
3. How do you classify climate- and weather-related hazards?
 - A. anthropogenic
 - B. biological
 - C. chemical
 - D. natural
4. Which of the following geologic features makes the provinces of La Union and Pangasinan are at risk to earthquakes?
 - A. Iba Fault
 - B. Lianga Fault
 - C. Manila Fault
 - D. Tablas Fault
5. Which of the following provinces has the highest risk of volcanic eruptions based on the DENR and Manila observatory report?
 - A. Bataan
 - B. Camiguin
 - C. Laguna
 - D. Sorsogon
6. Which of the following is NOT among the provinces with high proneness to landslide?
 - A. Cebu
 - B. La Union
 - C. Metro Manila
 - D. Mountain province
7. Which of the following is NOT included in the group?
 - A. earthquakes
 - B. landslides
 - C. mining
 - D. tsunamis

8. Which of the following areas is LEAST prone to earthquakes?
- A. Ifugao
 - B. La Union
 - C. Palawan
 - D. Tarlac
9. Which of the following provinces has the HIGHEST risk of volcanic-related hazard?
- A. Batangas
 - B. Batanes
 - C. Laguna
 - D. Sulu
10. Which of the following is NOT an example of geologic hazards?
- A. earthquakes
 - B. landslides
 - C. tropical cyclones
 - D. volcanic eruptions
11. Where can you find the Ring of Fire?
- A. Arctic Ocean
 - B. Atlantic Ocean
 - C. Indian Ocean
 - D. Pacific Ocean
12. Which of the following is an example of geologic hazard?
- A. earthquakes
 - B. flood
 - C. tornado
 - D. tropical cyclone
13. What refers to the movement of rock, debris, and soil down a slope?
- A. earthquakes
 - B. landslide
 - C. typhoon
 - D. volcanic eruptions
14. Why do you think that the majority of the Cordillera Administrative Region are included in the most landslide prone provinces in the Philippines? Because it is
- A. near the sea
 - B. situated near active volcanoes
 - C. near in mountain ranges
 - D. near NCR
15. Which of the following areas is LEAST prone to earthquakes?
- A. Cavite
 - B. Ifugao
 - C. Tarlac
 - D. Union



Additional Activities

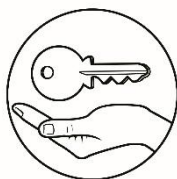
Activity 6: Interview me

Directions. Interview a family member, a relative, neighbor or anyone who experienced geologic hazards and answer the questions below. Limit your answer in 2-3 sentences.

1. Have you ever experienced any form of geologic hazards such as volcanic eruptions, earthquakes, and landslides? How did you feel? What did you do during and after the situation?

2. If you have never experienced any form of hazards, look for someone who was able to witness and experience it first-hand. Ask them their feelings and thoughts during and after the hazard event. Also, ask them the things they did during and after the scenario.

Refer to scoring rubrics for short answer question.



Answer Key

<p>What I Can Do Activity 5 Answers may vary among students</p> <p>Assessment</p> <p>1. A 2. A 3. D 4. C 5. B 6. C 7. C 8. C 9. D 10. C 11. D 12. A 13. B 14. C 15. A</p> <p>Additional Activities Activity 6 Answers may vary among students</p>	<p>What's New Activity 2 Answers may vary among students</p> <p>What's More Activity 3</p> <p>Earthquakes: Surigao Del Sur, La Union, and Benguet Volcanic eruptions: Camiguin, Sulu, and Biliran Landslides: Marinduque, Rizal and, Cebu Hazard map expose areas that are at risk to certain hazards.</p> <p>What I Have Learned Activity 4</p> <p>1. Ring of fire 2. Natural 3. Philippine trench, active faults 4. Small 5. Anthropogenic</p>	<p>What I Know</p> <p>1. A 2. D 3. C 4. A 5. D 6. A 7. C 8. C 9. C 10. A 11. D 12. D 13. C 14. D 15. A</p> <p>What's In Activity 1</p> <p>Cause: Possible answers Earthquakes -when rock underground suddenly breaks along a fault. Volcanic Eruptions -movement of tectonic plates causing magma to rise to the surface. Landslides -Slow weathering of rocks, soil erosion, earthquakes and volcanic activity Effects: Answers may vary among students</p>
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Rubrics for short answer

CRITERIA	3 Above Expectation	2 Meets Expectation	1 Below Expectation
Analysis	Response provide an in-depth analysis of the questions given. Shows an understanding of the lesson content. Examples were given to explain the concept presented.	Response provides an analysis of the questions given. Shows a little understanding of the lesson content. Examples were not given to explain the concept presented.	Response does not provide an analysis of the questions given. Shows no understanding of the lesson content. Examples were not given to explain the concept presented
Clarity	The thoughts were clearly expressed. The organization of words in a sentence was clearly exemplified.	The thoughts were slightly clear. The organization of words in a sentence was not exemplified clearly.	The thoughts were unclear. There is no organization of words in a sentence.
Writing Skills	Clear writing, complete sentence, no errors in grammar and spelling	Clear writing, complete sentence with minimal errors in grammar and spelling	Unclear writing, incomplete sentence, ample errors in grammar and spelling

References

- Bagayas, Samantha. 2018. "Why are the Philippines and Indonesia prone to natural hazards?". *Rappler*, October 19, 2018. Accessed May 19, 202. <https://www.rappler.com/move-ph/214623-why-philippines-indonesia-prone-natural-hazards>
- Djohannelene. 2017. "Landslide Prone Area in the Philippines." Accessed May 17, 2020. <https://theresilientperspective.wordpress.com/2017/01/13/landslide-prone-area-in-the-philippines/>
- Dugo, Fehl. 2017. "Why is the Philippines Prone to Typhoons and Earthquakes?." Accessed May 18, 2020. <https://philpad.com/why-is-the-philippines-prone-to-typhoons-and-earthquakes/>
- Ellis, Jessica. 2020. "What are Geological Processes?." Accessed May 18, 2020. <https://www.wisegeek.com/what-are-geological-processes.htm>
- Esquire Philippines. 2018. "The Philippines is the Third-Riskiest Country When it Comes to Natural Disasters." Accessed May 18, 2020. <https://www.esquiremag.ph/life/travel/world-risk-index-2017-philippines-a00203-20180502>
- Jacobs, Thea. 2020. "What causes a volcano to erupt, how they formed and different types of volcano revealed." *The Sun*, January 16, 2020. May 19, 2020. <https://www.thesun.co.uk/tech/6246894/volcano-formation-eruptions-different-types/>
- National Curriculum and Assessment Centre, Georgia. 2012. "Teaching Disaster risk Reduction with Interactive Methods." Accessed May 19, 2020. https://www.preventionweb.net/files/28375_28294engkatastrofebiweb2.pdf?fbclid=IwAR377KPI7fZLYMdCEXPzorYSsSmxbY4Cwd4PLct-cA_eM5IOrtsviM88QxY
- Nelson, Stephen A. 2018. "Natural Hazards and Natural Disaster". Accessed May 19, 2020. http://www.tulane.edu/~sanelson/Natural_Disasters/introduction.htm
- Prevention web. 2015. "Hazard." Accessed May 19, 2020. <https://www.preventionweb.net/risk/hazard>
- ProfProfsQuizzes. 2026. "Earthquakes! Phase 2 Quiz." Accessed May 20, 2020. <https://www.proprofs.com/quiz-school/quizshow.php?title=earthquakes-phase-2-quiz&q=1>
- The Manila Observatory. 2005. "Mapping Philippine Vulnerability to Environmental Disasters." Accessed May 18, 2020. <http://vm.observatory.ph/hazard.html>

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