

Department of Education
National Capital Region

**SCHOOLS DIVISION OFFICE
MARIKINA CITY**

Disaster Readiness and Risk Reduction

Module 11

Earthquake Hazards and Interpretation of
Different Earthquake Hazard Map



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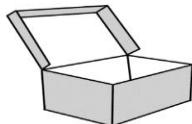
Cover Illustrator:

Christine Ann G. Faraon



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What I Need to Know

This module was designed and written with you in mind. It is here to help you to analyze the effects of different earthquake hazards and interpret the different earthquake hazard maps. 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 is divided into two lessons, namely:

- Lesson 1 – Analysis on the effects of the different earthquake hazards
- Lesson 2 – Interpretation of different earthquake hazard maps

After going through this module, you are expected to analyze the effects of the different earthquake hazards (DRR11/12-If-g-19) and interpret different earthquake hazard maps (DRR11/12-If-g-20).

Specifically, you are expected to

1. identify the effects of different earthquake hazards that can affect home and community;
2. explain the effects of different earthquake hazards that can affect home and community;
3. interpret the different earthquake hazard maps;
4. create own map of areas exposed to earthquake hazards; and
5. develop a family emergency preparedness plan to guide them on what to do before, during, and after an earthquake.



What I Know

Choose the letter of the best answer. Write the chosen letter on a separate sheet of paper.

1. What happened during ground rupture structures built across fault compared to the structures built adjacent to the fault?
 - A. It acquires less damage
 - B. It acquires zero damage
 - C. It acquires equal damage
 - D. It acquires greater damage

2. A void was created in your area during an earthquake. This void stocked water causing a permanent flood. What do you think is the reason for this?
- A. Fire
 - B. Tsunami
 - C. Liquefaction
 - D. Ground subsidence
3. All of the following may cause flood **EXCEPT** one. Which one is it?
- A. Tsunami
 - B. Broken dams
 - C. Ground rupture
 - D. Ground subsidence
4. Which of the following could be the effect of liquefaction?
- A. It causes tsunami.
 - B. Underground pipes and tanks rise to the surface.
 - C. Structures built across a fault either collapse or rip apart.
 - D. The void created stores water causing a permanent flood in the area.
5. Which of the following could be the reason of fire hazards during earthquakes?
- A. Earthquakes can break dams, reservoirs, and riprap where a fire starts.
 - B. Earthquakes can break electrical posts, power lines, and gas lines where a fire starts.
 - C. Earthquakes can make the sand or soil and groundwater mix during shaking causing the ground to act like quicksand.
 - D. All of the above
6. All of the following are the effects of earthquake hazards **EXCEPT** one. Which one is it?
- A. During earthquakes, rocks and soil rapidly roll along steep slopes causing nearby houses to be protected.
 - B. Ground shaking can cause the objects in a building to fall which may injure anyone nearby Political standing.
 - C. Earthquake can break dams and ripraps of rivers causing the water to overflow and flood the area Sanitation management.
 - D. Earthquake can overturn electrical posts, break power lines and gas lines which usually starts fire causing great loss in properties and lives.

7. All of the following are different earthquake hazards that can cause loss of lives and damage to the property **EXCEPT** one. Which one is it?
- Tsunami
 - Ground rupture
 - Ground shaking
 - Geothermal energy extraction
8. Which of the following information is **NOT** included in geographical maps that are used by the experts in making earthquake hazard map?
- soil compositions
 - ground conditions
 - water temperature
 - distribution of different rock units
9. Which of the following **DOES NOT** show the use of ground shaking susceptibility map?
- Predict occurrence of tsunami
 - For management of land use
 - In formulating building codes
 - Risk assessment and evaluation
10. Which of the following statements explain the reason why West Valley Fault (WVF) is always being monitored by the experts?
- Structures found in WVF are not well built.
 - Cost of living in these areas are very expensive.
 - Construction along WVF do not follow existing building codes.
 - Areas located here will experience the strongest effect of the earthquake.
11. What is the other name for Philippine Disaster Risk Reduction and Management Act of 2010?
- Republic Act 10112
 - Republic Act 10121
 - Republic Act 11021
 - Republic Act 10211
12. Which of the following is **NOT** the aim of Philippine Disaster Risk Reduction and Management Act of 2010?
- It provides a framework for dealing with disasters.
 - It strengthens Philippines' disaster risk management.
 - It shows how effective our government during disasters.
 - It encourages readiness of the community towards disasters.



13. Which of the following is NOT the priority area of National Disaster Risk Reduction and Management Framework (NDRRMF)?
- A. Preparedness
 - B. Prevention
 - C. Recreation
 - D. Response
14. Which priority area that deals with restoring facilities and livelihood after a disaster?
- A. Disaster response
 - B. Disaster preparedness
 - C. Rehabilitation and recovery
 - D. Disaster prevention and mitigation
15. Which priority area that deals with strengthening capacity of a community before a disaster?
- A. Disaster response
 - B. Disaster preparedness
 - C. Rehabilitation and recovery
 - D. Disaster prevention and mitigation

Lesson 1

Analysis on the effects of the different earthquake hazards



What's In

In the previous module you learned about various potential earthquake hazards. You learned that (SIEGFRIED 2018) states that earthquake hazards include any physical phenomenon associated with an earthquake that can produce tremendous effects on human life. Also, hazards are the natural phenomena that can create an impact in a region, regardless of whether there is anyone around to experience them or not.

Before you proceed to the lessons of this module, take time to read the following information.

Potential Earthquake Hazards	
Ground shaking	(National Protection and Programs Directorate 2016) defined it as vibration of the ground during an earthquake.
Ground rupture	Offset of the ground
Liquefaction	Mixing of soil and groundwater which acts like a quicksand
Ground subsidence	(IITB-Monash Research Academy 2020) defined it as sinking or settling of the ground surface.
Tsunami	Series of giant sea waves generated by an earthquake with magnitude greater than 7.0
Landslide	This hazard is defined as the movement of the rock, debris, or earth down a slope.

What's New

To understand more about this lesson, accomplish the activity below called “New Fallen Phrase”. Write your decoded phrases on a separate sheet of paper.

Activity 1.1. New Fallen Phrase



k n p		
s k e	e t t	p o o n
d e	t p n b r e n i n f e	g o u d t

Find the hidden phrases by using the letters directly below each of the blank squares. Each letter is used once.

Decoded Phrases:

- 1.
- 2.
- 3.
- 4.
- 5.





What Is It

Phrases that you revealed a while ago in the previous activity are related to this lesson since they are all effects of the different earthquake hazards. For now, read additional information below about this topic before accomplishing your next activity.

Effects of earthquake hazards

Ground shaking

Ground shaking can cause the objects in a building to fall which may injure anyone nearby. When the severity of ground shaking increases, it can cause damage to the infrastructure, or even can cause collapsing in the worst-case scenarios. Moreover, ground shaking can trigger other earthquake hazards such as liquefaction and landslides. The intensity of ground shaking depends on bedrock type, duration and intensity of the earthquake, and the distance of the area from the epicenter.



Figure 1.1. Damage to structure

Figure 1.2. Triggered Liquefaction

Source:

- (1.1) Accessed September 3, 2020. https://frontlearners.com/blended/pluginfile.php/6567/mod_resource/content/4/index.html.
- (1.2) Accessed September 3, 2020. https://frontlearners.com/blended/pluginfile.php/6567/mod_resource/content/4/index.html.

Ground rupture

Another hazard is ground rupture where the ground along a fault is displaced. Structures built across a fault will be seriously damaged, rip apart, or collapse. On the other hand, structures built adjacent to the fault will acquire less damage compared to the structures built across the fault.

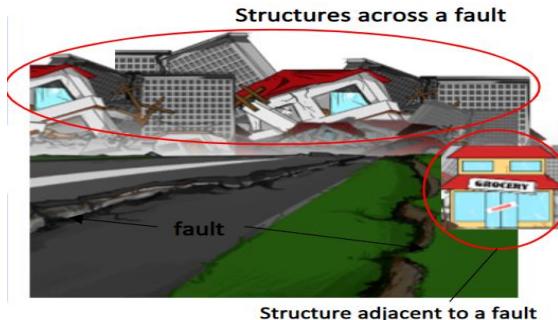


Figure 1.3. Structure across and adjacent to a fault

Source:

- (1.3) Accessed September 3, 2020. https://frontlearners.com/blended/pluginfile.php/6567/mod_resource/content/4/index.html.
- (1.4) "Catigbian 2 earthquake.JPG." 2013. Accessed September 3, 2020. https://commons.wikimedia.org/wiki/File:Catigbian_2_earthquake.JPG.



Figure 1.4. Ground rupture effect

Liquefaction

Recall that liquefaction happens when the sand or soil and groundwater mix during shaking causing the ground to act like quicksand. When the ground act as quicksand, the foundation and support of structures weaken causing the structures to sink into the ground, overturn, or collapse. On the other hand, underground pipes and tanks may rise to the surface. After the event, areas can be left covered in a deep layer of mud.



Figure 1.5. Car sinks into the ground



Figure 1.6. Effects of liquefaction

Source:

- (1.5) Accessed September 3, 2020. https://frontlearners.com/blended/pluginfile.php/6567/mod_resource/content/4/index.html.
- (1.6) Perduta. "Liquefaction.JPG." 2011. Accessed September 3, 2020. <https://commons.wikimedia.org/wiki/File:Liquefaction.JPG>.

Ground subsidence

We have learned that ground subsides due to ground shaking or downward displacement of one side of a fault during an earthquake. When the ground surface subsides totally, the void left may stock water causing a permanent flood in the area.

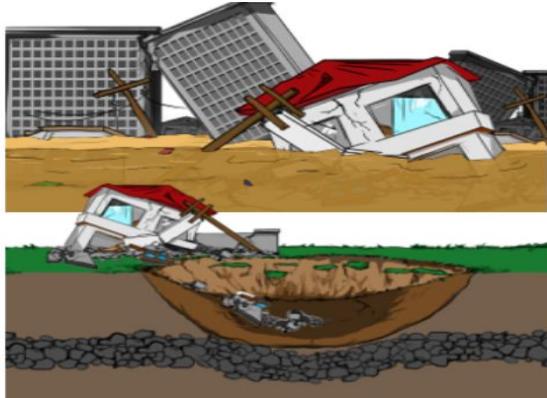


Figure 1.7. Downward displacement of one side of fault

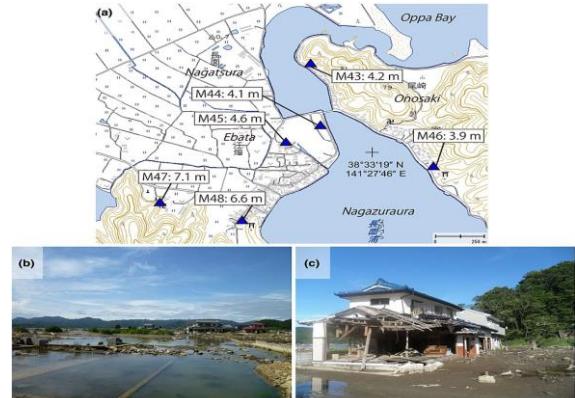


Figure 1.8. Effects of ground subsidence

Source:

- (1.7) Accessed September 3, 2020. https://frontlearners.com/blended/pluginfile.php/6567/mod_resource/content/4/index.html.
- (1.8) Tsuji et.al. "Miyagi - Ishinomaki -- Onosaki and Nagatsura -a- Tsunami heights -b and c- View of tsunami damage and ground subsidence.jpg." 2014. Accessed September 3, 2020. https://commons.wikimedia.org/wiki/File:Miyagi_-_Ishinomaki_-_Onosaki_and_Nagatsura_-a_-Tsunami_heights_-b_and_c_-View_of_tsunami_damage_and_ground_subsidence.jpg.

Tsunami

It can cause great damages and can destroy houses, uproot trees, devastate nearby properties, and drown and kill people and animals. Moreover, a tsunami can cause flood which can extend inland by a thousand feet or more.



Figure 1.9. Tsunami



Figure 1.10. Effects of tsunami

Source:

- (1.9) Accessed September 3, 2020. https://frontlearners.com/blended/pluginfile.php/6567/mod_resource/content/4/index.html.
- (1.10) Ministry of Land, Infrastructure, Transport and Tourism (MLIT) (Japan). "File:Sendai Airport after the tsunami.jpg." 2014. Accessed September 3, 2020. https://commons.wikimedia.org/wiki/File:Sendai_Airport_after_the_tsunami.jpg.

Flood

It can be caused by water from dams, reservoirs, or river. Earthquake can break dams and riprap of rivers causing the water to overflow and flood the area.



Figure 1.11. Damage dams caused floods



Figure 1.12. Effect the destroyed dam cause by an earthquake

Source:

- (1.11) Accessed September 3, 2020. https://frontlearners.com/blended/pluginfile.php/6567/mod_resource/content/4/index.html.
- (1.12) Philippinepresidency. "Ondoy16.jpg." 2019. Accessed September 3, 2020. <https://commons.wikimedia.org/wiki/File:Ondoy16.jpg>.

Landslide

During earthquakes, rocks and soil rapidly roll along steep slopes. The falling rocks may hit people, houses or vehicles causing accidents.



Figure 1.13. Falling of rocks



Figure 1.14. Effects of landslide

Source:

- (1.13) Accessed September 3, 2020. https://frontlearners.com/blended/pluginfile.php/6567/mod_resource/content/4/index.html.
- (1.14) "Landslide SierraLeone August2017.jpg." 2017. Accessed September 3, 2020. https://commons.wikimedia.org/wiki/File:Landslide_SierraLeone_August2017.jpg.

Fire

Earthquake can overturn electrical posts, break power lines and gas lines which usually starts fire causing great loss in properties and lives.



Figure 1.15. Damage to structure



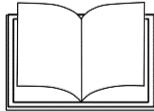
Figure 1.16. Effects of fire

Source:

- (1.15) Accessed September 3, 2020. https://frontlearners.com/blended/pluginfile.php/6567/mod_resource/content/4/index.html.
- (1.16) "FIRE FIGHTING, FIREFIGHTERS WITH HOSE AT BURNING BUILDING." Accessed September 3, 2020. <https://pixy.org/6093747/>.

In summary, here are the effects of different earthquake hazards

Earthquake Hazard	Effects
Ground shaking	Objects fall which hit people nearby; structures either damage or collapse
Ground rupture	Structures built across a fault either collapse or rip apart
Liquefaction	Structures either sink, overturn, or collapse while pipelines arise above the ground
Ground subsidence	The void created stores water causing a permanent flood in the area
Tsunami	Flood and loss of properties and lives
Flood (caused by broken dams/reservoirs)	Loss of properties and lives
Landslide	Accidents
Fire	Loss of lives and properties

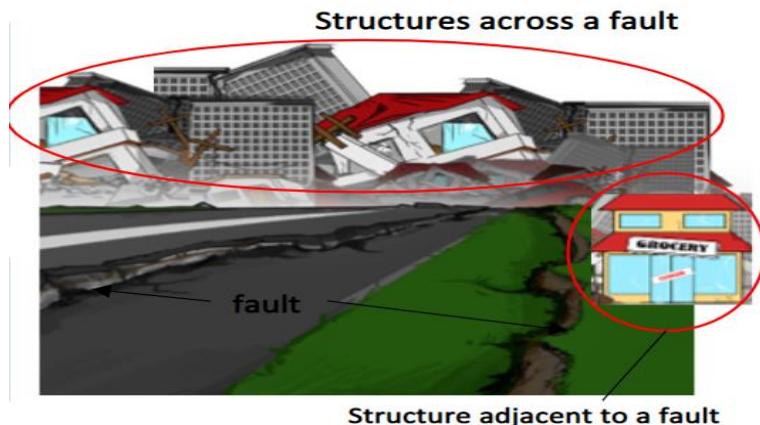


What's More

Activity 1.2. Picture Analysis

Analyze the given pictures below. Identify and explain the effects of earthquake hazards to the home and community. Write your answer on a separate sheet of paper.

1. Effect(s) of Earthquake hazard: _____



Source: Accessed September 3, 2020. https://frontlearners.com/blended/pluginfile.php/6567/mod_resource/content/4/index.html.

Explanation:

2. Effect(s) of Earthquake hazard: _____



Source: Accessed September 3, 2020. https://frontlearners.com/blended/pluginfile.php/6567/mod_resource/content/4/index.html.



Explanation:

3. Effect(s) of Earthquake hazard: _____



Source: Accessed September 3, 2020. https://frontlearners.com/blended/pluginfile.php/6567/mod_resource/content/4/index.html.

Explanation:

SCORING RUBRIC:

NOTE: Two (2) points will be given for each identified effects of earthquake hazards.
This rubric will be used in checking the explanation part of this activity.

Criterion	Excellent (4 pts)	Good (3 pts)	Approaching standard (2 pts)	Needs Improvement (1pt)
Ideas and Content	What you are writing about is clear and well- expressed, including specific examples to demonstrate what you learned. Well done	What you are writing is clear. You answered the question. Some support may be lacking, or your sentences may be a bit awkward. Overall a decent job.	You put thought into this, but there is no real evidence of learning. More specific information is needed, or you need to follow the directions more closely.	There is no clear or specific explanation in answer to the question.
Use of terms	Your answer included all the terms from the lesson that applied to the question asked. All terms are fully defined and used in the proper context.	Your answer included several terms from the lesson, demonstrating adequate understanding of the material.	Only one term from the lesson is used in the answer. Try for a few more, next time.	No terms from the lesson are used.

Sentence fluency	Sentences are complete and they are read out loud. Your writing flows.	Sentences are complete and able to be understood.	Some sentences are complete and easy to understand. Others require some work.	Sentences are incomplete or too long. It makes reading them difficult.
Conventions	No punctuation or structural mistakes. No spelling errors. Your writing shows full awareness of the rules of English use.	Use of punctuation marks and capitals as well as spelling is mostly correct. Few errors exist in your answer.	Mistakes using end marks or capitals as well as spelling mistakes make writing hard to read.	Few end marks or capital letters. Answers contain numerous spelling or structural errors.

Source: Reazon System, Inc. 2020. Accessed August 9, 2020.
<https://www.rcampus.com/rubricshowc.cfm?code=U66W43&sp=yes&>



What I Have Learned

Activity 1.3. Sentence completion

Fill in the blanks with the words or phrase to check what you have learned in this lesson. Write your answer on a separate sheet of paper.

1. (SIEGFRIED 2018) states that _____ include any physical phenomenon associated with an earthquake that can produce tremendous effects on human life.
2. Effects of different earthquake hazards include the following.

Ground shaking can cause _____ to the infrastructures, or even can cause collapsing in the worst-case scenarios. When ground rupture occurs, structures built adjacent to the fault will acquire _____ damage compared to the structures built across the fault. Liquefaction happens when the sand or soil and groundwater mix during shaking causing the ground to act like _____. Earthquake can overturn electrical posts, break power lines and gas lines which usually starts _____ causing great loss in properties and lives.



What I Can Do

Activity 1.4

Since you know already about the effects of different earthquake hazards, let us check if you can transfer your new knowledge or skills into real life situations or concerns.

You will do it by pair. Ask any members of your family like mother, father, sister, brother etc., to be your partner in doing this activity. Write the importance of having knowledge on the effects of earthquake hazards in your home, school, and community. Write your answer on a separate sheet of paper.



SCORING RUBRIC:

NOTE: This rubric will be used in checking each column including the conclusion part of the activity below.

Criterion	Excellent (4 pts)	Good (3 pts)	Approaching standard (2 pts)	Needs Improvement (1pt)
Ideas and Content	What you are writing about is clear and well-expressed, including specific examples to demonstrate what you learned. Well done	What you are writing is clear. You answered the question. Some support may be lacking, or your sentences may be a bit awkward. Overall a decent job.	You put thought into this, but there is no real evidence of learning. More specific information is needed, or you need to follow the directions more closely.	There is no clear or specific explanation in answer to the question.
Use of terms	Your answer included all the terms from the lesson that applied to the question asked. All terms are fully defined and used in the proper context.	Your answer included several terms from the lesson, demonstrating adequate understanding of the material.	Only one term from the lesson is used in the answer. Try for a few more, next time.	No terms from the lesson are used.
Sentence fluency	Sentences are complete and they are read out loud. Your writing flows.	Sentence are complete and able to be understood.	Some sentences are complete and easy to understand. Others require some work.	Sentences are incomplete or too long. It makes reading them difficult.
Conventions	No punctuation or structural mistakes. No spelling errors. Your writing shows full awareness of the rules of English use.	Use of punctuation marks and capitals as well as spelling is mostly correct. Few errors exist in your answer.	Mistakes using end marks or capitals as well as spelling mistakes make writing hard to read.	Few end marks or capital letters. Answers contain numerous spelling or structural errors.

Source: Reazon System, Inc. 2020. Accessed August 9, 2020.

<https://www.rcampus.com/rubricshowc.cfm?code=U66W43&sp=yes&>

IMPORTANCE OF KNOWING HAZARD AND ITS TYPE

	IN YOUR HOUSE	IN YOUR SCHOOL	IN YOUR COMMUNITY
YOUR PARTNER			
YOU			
Conclusion			



Assessment

Choose the letter of the best answer. Write the chosen letter on a separate sheet of paper.

1. Which of the following could be the reason of fire hazards during earthquakes?
 - A. Earthquakes can roads where a fire starts.
 - B. Earthquakes can break dams, reservoirs, and riprap where a fire starts.
 - C. Earthquakes can break electrical posts, power lines, and gas lines where a fire starts.
 - D. All of the above
2. A void was created in your area during an earthquake. This void stocked water causing a permanent flood. What do you think is the reason for this?
 - A. Fire
 - B. Tsunami
 - C. Liquefaction
 - D. Ground subsidence
3. What happened during ground rupture structures built across fault compared to the structures built adjacent to the fault?
 - A. It acquires less damage
 - B. It acquires zero damage
 - C. It acquires equal damage
 - D. It acquires greater damage
4. Which of the following could be the effect of liquefaction?
 - A. It causes tsunami.
 - B. Underground pipes and tanks rise to the surface.
 - C. Structures built across a fault either collapse or rip apart.
 - D. The void created stores water causing a permanent flood in the area.
5. All of the following may cause flood **EXCEPT** one. Which one is it?
 - A. Tsunami
 - B. Broken dams
 - C. Ground rupture
 - D. Ground subsidence



Lesson 2

Interpretation of different earthquake hazard maps



What's In

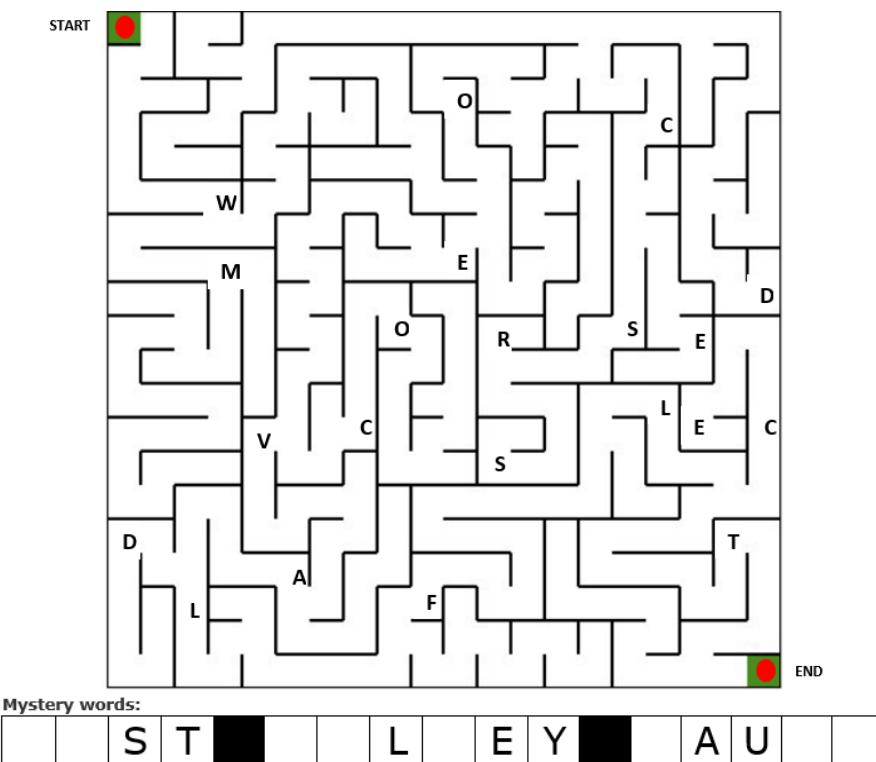
In lesson one, you have learned the different effects of earthquake hazards. In order for you to be prepared for this type of disaster, this lesson will help you describe and explain what an earthquake hazard map is, interpret such hazard map, and how it is made.



What's New

Activity 2.1. Where to go?

Can you find your way through the end of the maze? Trace where the circle will go inside the maze from the start point to end point. Write down the letters that you pass through to complete the mystery words. Some letters are already given in the boxes as your clues.





What Is It

Earthquake hazard map is a special type of map that shows the possible physical and geographical effect of an earthquake within a particular area or region. It is also known as **ground shaking hazard map**.

Experts can create earthquake hazard map by analyzing the geographical features and historical seismic record of a particular region. They can locate fault lines or tectonic plate boundaries to determine which areas are at risk of earthquakes.

Looking at the Earthquake hazard map below, the one in circle (Region 3) has the most number of provinces that are considered to be at high risk. These provinces are Zambales, Tarlac, Pampanga, and Nueva Ecija. The National Capital Region or NCR (pointed arrow) has a medium risk of earthquakes.

Looking at Figure 2.1, the locations of active faults that run throughout the country align with the location of provinces at risk of earthquakes. Most of the provinces that are located above the active faults have a high risk of earthquakes.

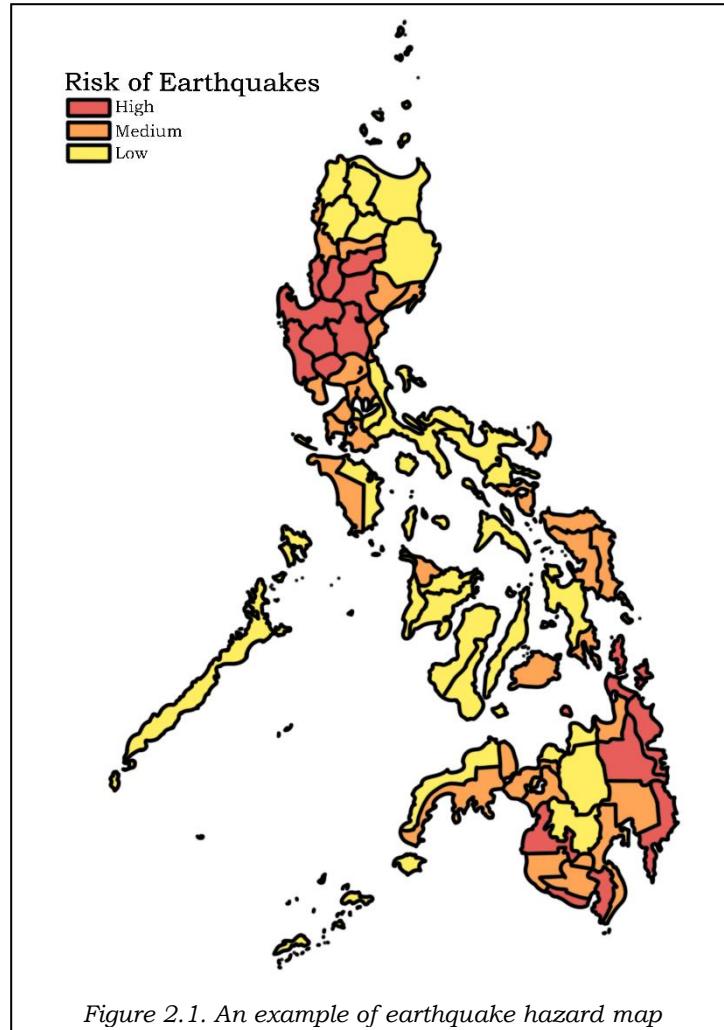


Figure 2.1. An example of earthquake hazard map



Distribution of Active Faults and Trenches in the Philippines

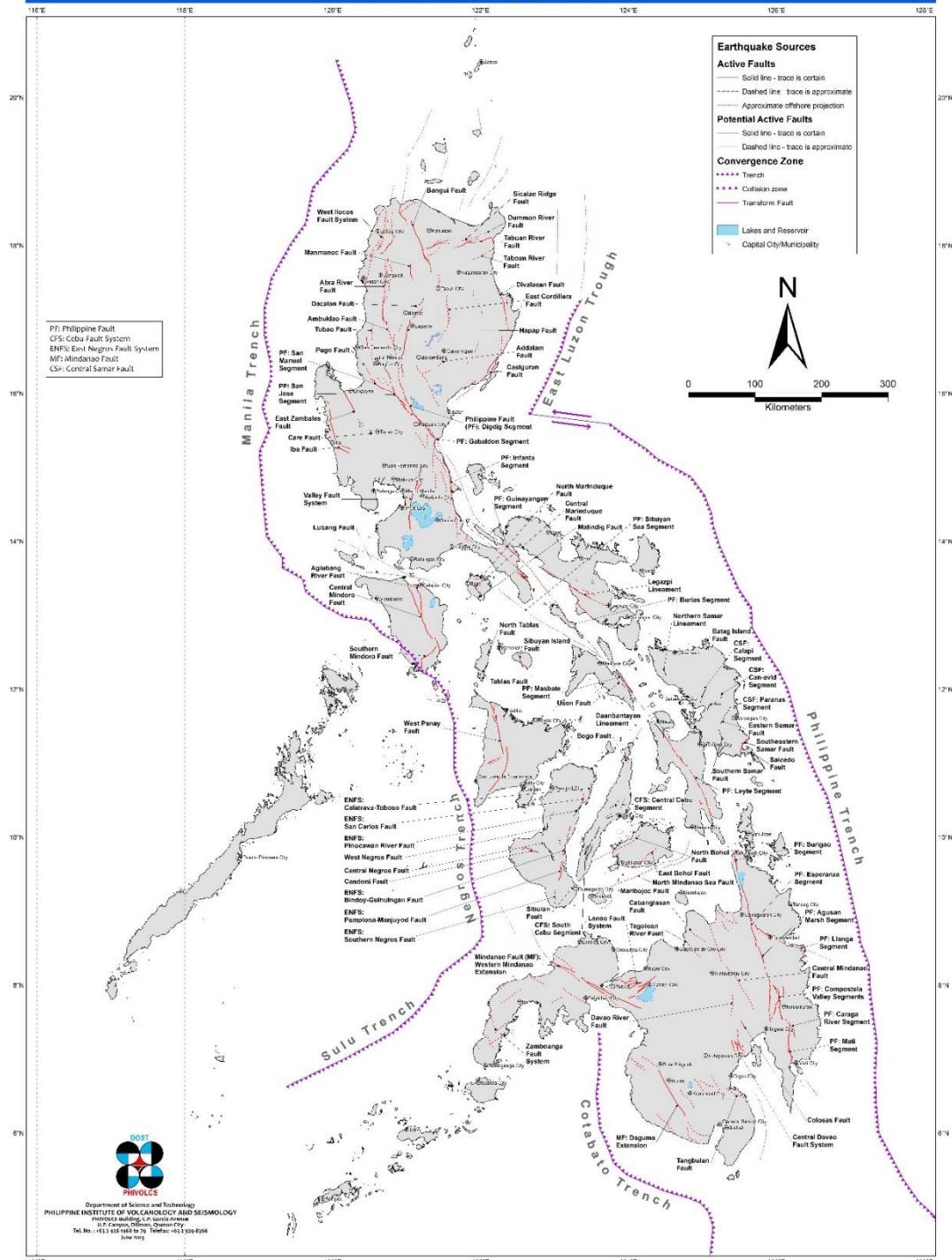


Figure 2.2. Distribution of Active Faults and Trenches in the Philippines

Source:

https://gisweb.phivolcs.dost.gov.ph/phivolcs_hazardmaps/00.%20Philippines/Distribution%20of%20Active%20Faults%20in%20the%20Philippines_June%202019.jpg

Experts can also create an earthquake hazard map that shows susceptibility of a region to ground shaking. **Ground shaking** is caused by the release of stored energy in the lithosphere that was released during an earthquake. Its strength is measured in terms of velocity, acceleration, frequency, and duration.

Ground shaking also depends on the properties of the ground material and the geology of the area involved. Each kind of ground material compositions reacts to seismic waves differently. Experts can analyze geological maps that contain information about the distribution of different rock units, soil compositions, and ground conditions to create an earthquake hazard map.

Scientists may not accurately predict the location, time, and magnitude of an earthquake, but by evaluating various geographical map information, they can create a **ground shaking susceptibility map** that can tell the most at risk areas even without knowing where and when an earthquake will appear. Such map is important for land use management, building codes formulation, and risk assessment.

The **West Valley Fault** or WVF (Figure 2.3) is a 100 km long active fault that runs through some part of Bulacan, Rizal (Rodriguez), Quezon City, Marikina City, Pasig City, Makati City, Taguig City, and Muntinlupa City, Laguna, and Cavite. It is part of the Valley Fault System that stretches across the Greater Metro Manila Area. The WVF cut across numerous heavy populated cities, which are also filled with residential, commercial, and economic centers.

The areas that are located along the WVF will experience the strongest effect of the earthquake. These areas are expected to suffer a magnitude of Intensity 8 to 9 on the actual event. Construction of these structures in these areas should heavily adhere to existing building codes and must be well-built.





Figure 2.3. The West Valley Fault

Source: "THE BIG ONE PART 2." National Research Council of The Philippines. 2017. Accessed September 7, 2020.
http://nrcp.dost.gov.ph/index.php?option=com_content&view=article&id=279&Itemid=72.

Moreover, the Philippine government created a law that will address the need for disaster preparedness and risk reduction. The Republic Act 10121 (also known as the Philippine Disaster Risk Reduction and Management Act of 2010) strengthens the Philippines' disaster risk reduction and management system. The act is task in providing a framework and institutionalizing the national risk reduction and management plans as well as appropriating funds. In accordance with the law, the National Disaster Risk Reduction and Management Plan (NDRRMP) shall be in conformity with the National Disaster Risk Reduction and Management Framework (NDRRMF) (Vengco, 2016).

The framework defines the four priority areas which correspond to the structure of the National Risk Reduction Council (NDRMMC) which are as follows:

1. disaster prevention and mitigation
2. disaster preparedness
3. disaster response
4. rehabilitation and recovery

The priority areas are connected and in continuation with one another as Philippines is a country prone to various hazards.

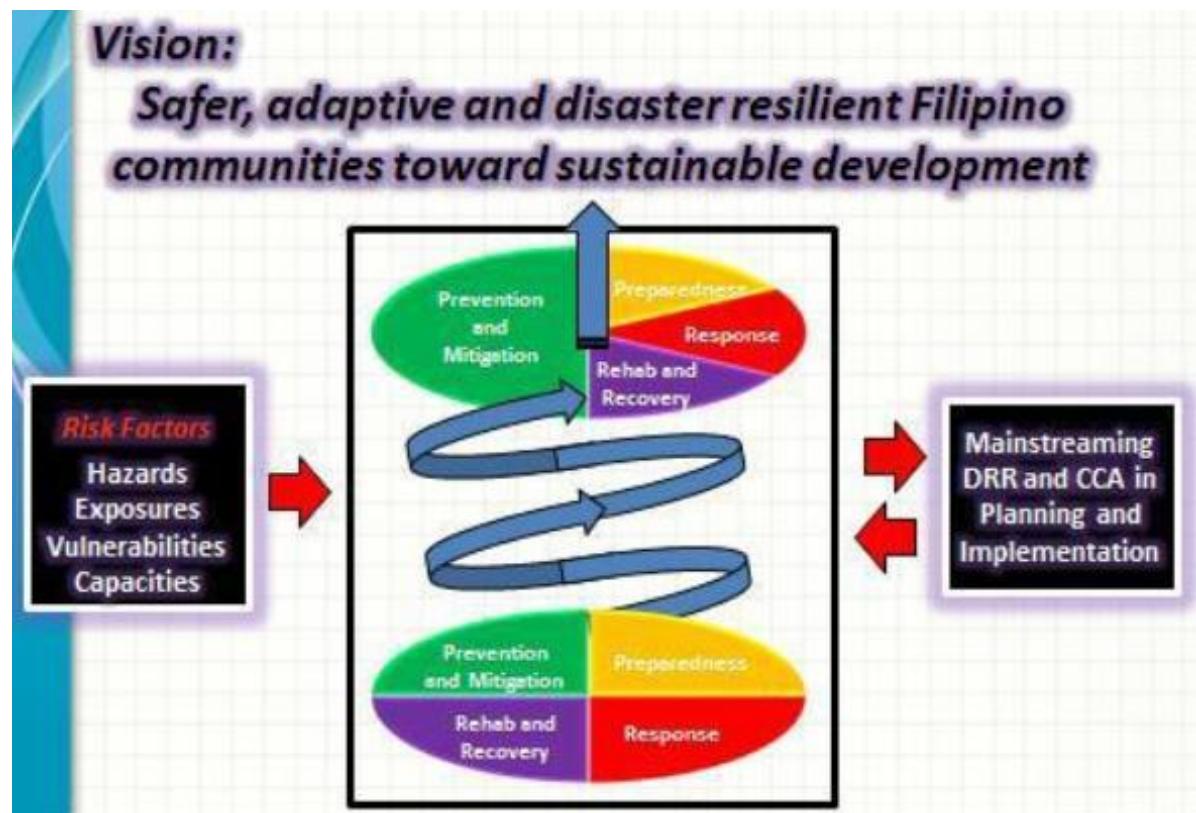
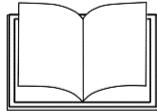


Figure 2.4. National Disaster Risk Reduction and Management Framework (NDRRMF)
Source: "NDRRMF." Accessed September 7, 2020. <http://www.ndrrmc.gov.ph/index.php/2-uncategorised/1675-ndrrmc-framework>.

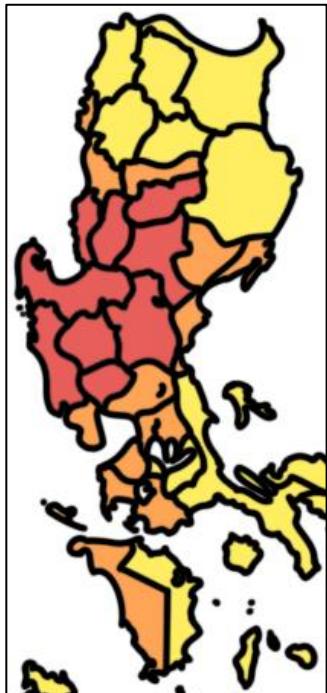




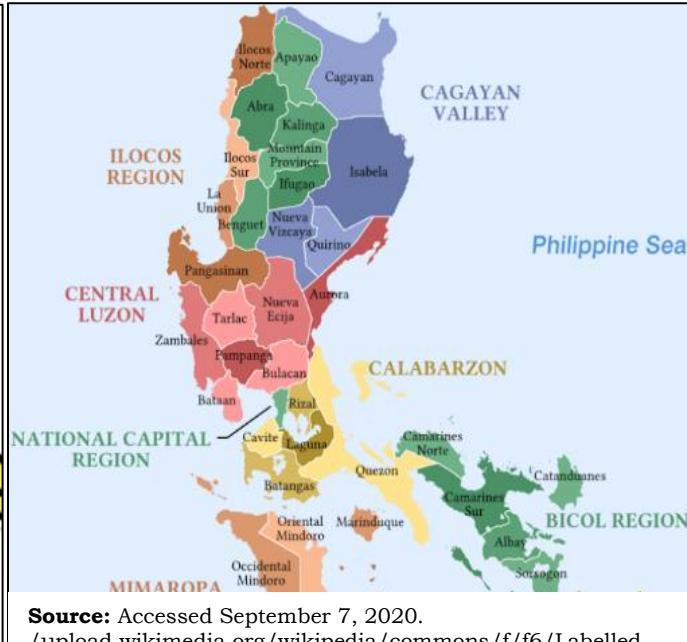
What's More

How good are you with maps? Try to analyze the following hazard maps by doing the following activity. Place your answers in a separate sheet of paper.

Activity 2.2 Find me



Box no. 1



Source: Accessed September 7, 2020.
[/upload.wikimedia.org/wikipedia/commons/f/f6/Labelled_map_of_the_Philippines_-_Provinces_and_Regions.png?](https://upload.wikimedia.org/wikipedia/commons/f/f6/Labelled_map_of_the_Philippines_-_Provinces_and_Regions.png)

Box no. 2

- A. The top places in the Philippines that are prone to earthquakes are shaded in box number 1. Using the Philippine map in box number 2 (or you may use your own map if you have), give ten (10) specific provinces that are vulnerable to earthquakes.

1. _____
2. _____
3. _____
4. _____
5. _____

6. _____
7. _____
8. _____
9. _____
10. _____

- B. Using the map in Figure 2.1 (Active Faults and Trenches), why do you think the places you listed above are prone to earthquakes? _____

- C. How do you think the Philippine Fault Zone or PFZ in Figure 2.1 affect the West Valley Fault in Figure 2.3? _____



What I Have Learned

Activity 2.3. Complete me

Complete the following statements based on what you have learned about the Earthquake hazard map. Choose your answers found inside the box. Write your answers on a separate sheet of paper.

earthquake hazard map	physical	particular area
hazard map	fault lines	seismic record
geographical	risk	tectonic plate
released	ground shaking	stored energy

(1) _____ is a special type of map that shows the possible (2) _____ and geographical effect of an earthquake within a (3) _____ or region. It is also known as ground shaking hazard map.

Experts can create earthquake hazard map by analyzing the (4) _____ features and historical (5) _____ of a particular region. They can locate (6) _____ or tectonic plate boundaries to determine which areas are at (7) _____ of earthquakes.

Experts can also create an earthquake hazard map that shows susceptibility of a region to ground shaking. (8) _____ is caused by the release of (9) _____ in the lithosphere that was (10) _____ during an earthquake. Its strength is measured in terms of velocity, acceleration, frequency, and duration.



What I Can Do

Activity 2.4. Here I am

Read the following instructions carefully. Do what is asked, then answer the following questions. Place your answers on a separate sheet of paper.

1. Make a map of your route coming from your house going to your school.



2. What structures or places that can be found along your way, around your house and around your school? Check the boxes opposite of those structures or places.

	Abandoned buildings
	Big houses
	Body of water (river, stream, fish pond)
	Bridge
	Buildings (ex: office, bank, city hall, hotel, condominium)
	Bus stops
	Cell site (ex: Smart, Globe)
	Church
	Construction sites
	Drainage
	Electric transmission area (ex: Meralco site)
	Electrical post
	Factory
	Farm
	Fire station /police station
	Hill or mountain
	Hospital building
	Impounding area (vehicles that were towed)
	Irrigation
	Mining area
	Muddy area

	Oil depot/gas station (ex: Shell, Petron)
	Playground
	Public park or garden
	Public parking area
	Railroad tracks
	Rice field
	Road with cracks
	School buildings
	Shops (ex: restaurant, shoe store)
	Supermarket
	Tall trees
	Train station
	Vacant lot
	Vehicle terminal (tricycle, jeepney)
	Waiting shed
	Warehouse
	Water dam
	Water facility (ex: Maynilad)
	Wet market
	Windmill
	Others: _____

3. Answer the following questions:

- a. What structures found around your house that are earthquake hazards?
- b. What made you say that these structures are earthquake hazards?
- c. What structures found near your school that are vulnerable to earthquake?
- d. Why are these structures vulnerable to earthquake?
- e. Why the structures that you see from your house going to your school prone to earthquake?



Assessment

Read each question carefully and choose the best answer. On a separate sheet of paper, write the letter of the correct answer.

1. Which of the following statements is **NOT TRUE** about Earthquake hazard map?
 - A. It is also known as ground shaking hazard map.
 - B. It shows the possible physical effect of an earthquake.
 - C. It presents geographical outcomes of an earthquake in an area or region.
 - D. It is a common type of map that shows the governmental boundaries of major cities.
2. Which earthquake hazards can easily be determined when using the earthquake hazard map?
 - A. Tsunami
 - B. Landslide
 - C. Subsidence
 - D. Ground shaking
3. Which of the following is **NOT** the function of earthquake hazard map?
 - A. It can determine fault lines.
 - B. It shows the geological features of an area.
 - C. It can predict the movement of plate boundaries.
 - D. It can tell the historical seismic record of a particular region.
4. Which of the following factors is **NOT** used in measuring the strength of ground shaking?
 - A. acceleration
 - B. distance
 - C. frequency
 - D. velocity
5. Which of the following cities is **NOT** part of the West Valley Fault?
 - A. Makati City
 - B. Quezon City
 - C. City of Manila
 - D. City of Marikina



Posttest

Choose the letter of the best answer. Write the chosen letter on a separate sheet of paper.

1. Which of the following **DOES NOT** show the use of ground shaking susceptibility map?
 - A. Predict occurrence of tsunami
 - B. For management of land use
 - C. In formulating building codes
 - D. Risk assessment and evaluation
2. Which of the following information is **NOT** included in geographical maps that are used by the experts in making earthquake hazard map?
 - A. soil compositions
 - B. ground conditions
 - C. water temperature
 - D. distribution of different rock units
3. Which of the following statements explain the reason why West Valley Fault (WVF) is always being monitored by the experts?
 - A. Structures found in WVF are not well built.
 - B. Cost of living in these areas are very expensive.
 - C. Construction along WVF do not follow existing building codes.
 - D. Areas located here will experience the strongest effect of the earthquake.
4. What is the other name for Philippine Disaster Risk Reduction and Management Act of 2010?
 - A. Republic Act 10112
 - B. Republic Act 10121
 - C. Republic Act 11021
 - D. Republic Act 10211
5. Which of the following is NOT the aim of Philippine Disaster Risk Reduction and Management Act of 2010?
 - A. It provides a framework for dealing with disasters.
 - B. It strengthens Philippines' disaster risk management.
 - C. It shows how effective our government during disasters.
 - D. It encourages readiness of the community towards disasters.

6. Which of the following is NOT the priority area of National Disaster Risk Reduction and Management Framework (NDRRMF)?
- Preparedness
 - Prevention
 - Recreation
 - Response
7. Which priority area that deals with strengthening capacity of a community before a disaster?
- Disaster response
 - Disaster preparedness
 - Rehabilitation and recovery
 - Disaster prevention and mitigation
8. Which priority area that deals with restoring facilities and livelihood after a disaster?
- Disaster response
 - Disaster preparedness
 - Rehabilitation and recovery
 - Disaster prevention and mitigation
9. All of the following are different earthquake hazards that can cause loss of lives and damage to the property **EXCEPT** one. Which one is it?
- Tsunami
 - Ground rupture
 - Ground shaking
 - Geothermal energy extraction
10. Which of the following could be the effect of liquefaction?
- It causes tsunami.
 - Underground pipes and tanks rise to the surface.
 - Structures built across a fault either collapse or rip apart.
 - The void created stores water causing a permanent flood in the area.
11. A void was created in your area during an earthquake. This void stocked water causing a permanent flood. What do you think is the reason for this?
- Fire
 - Tsunami
 - Liquefaction
 - Ground subsidence



12. All of the following may cause flood **EXCEPT** one. Which one is it?

- A. Tsunami
- B. Broken dams
- C. Ground rupture
- D. Ground subsidence

13. What happened during ground rupture structures built across fault compared to the structures built adjacent to the fault?

- A. It acquires less damage
- B. It acquires zero damage
- C. It acquires equal damage
- D. It acquires greater damage

14. Which of the following could be the reason of fire hazards during earthquakes?

- A. Earthquakes can break dams, reservoirs, and riprap where a fire starts.
- B. Earthquakes can break electrical posts, power lines, and gas lines where a fire starts.
- C. Earthquakes can make the sand or soil and groundwater mix during shaking causing the ground to act like quicksand.
- D. All of the above

15. All of the following are the effects of earthquake hazards **EXCEPT** one. Which one is it?

- A. During earthquakes, rocks and soil rapidly roll along steep slopes causing nearby houses to be protected.
- B. Ground shaking can cause the objects in a building to fall which may injure anyone nearby Political standing.
- C. Earthquake can break dams and riprap of rivers causing the water to overflow and flood the area Sanitation management.
- D. Earthquake can overturn electrical posts, break power lines and gas lines which usually starts fire causing great loss in properties and lives.



Additional Activities

Since you know already about the volcano hazard map, let us check if you can transfer your new knowledge or skills into real life situations or concerns. Knowing how to interpret the earthquake hazard map, develop a family emergency preparedness plan to guide them on what to do before, during, and after an earthquake. You are free to do whatever style you want in this activity. You can make infographics or tabular style of family emergency preparedness plan.

SCORING RUBRIC

NOTE: This rubric will be used in checking your essay.

Criterion	Excellent (4 pts)	Good (3 pts)	Approaching Standard (2 pts)	Needs Improvement (1pt)
Ideas and Content	What you are writing about is clear and well-expressed, including specific examples to demonstrate what you learned. Well done	What you are writing is clear. You answered the question. Some support may be lacking, or your sentences may be a bit awkward. Overall a decent job.	You put thought into this, but there is no real evidence of learning. More specific information is needed, or you need to follow the directions more closely.	There is no clear or specific explanation in answer to the question.
Use of terms	Your answer included all the terms from the lesson that applied to the question asked. All terms are fully defined and used in the proper context.	Your answer included several terms from the lesson, demonstrating adequate understanding of the material.	Only one term from the lesson is used in the answer. Try for a few more, next time.	No terms from the lesson are used.
Sentence fluency	Sentences are complete and they are read out loud. Your writing flows.	Sentences are complete and able to be understood.	Some sentences are complete and easy to understand. Others require some work.	Sentences are incomplete or too long. It makes reading them difficult.
Conventions	No punctuation or structural mistakes. No spelling errors. Your writing shows full awareness of the rules of English use.	Use of punctuation marks and capitals as well as spelling is mostly correct. Few errors exist in your answer.	Mistakes using end marks or capitals as well as spelling mistakes make writing hard to read.	Few end marks or capital letters. Answers contain numerous spelling or structural errors.

Source: Reazon System, Inc. 2020. Accessed August 9, 2020.
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