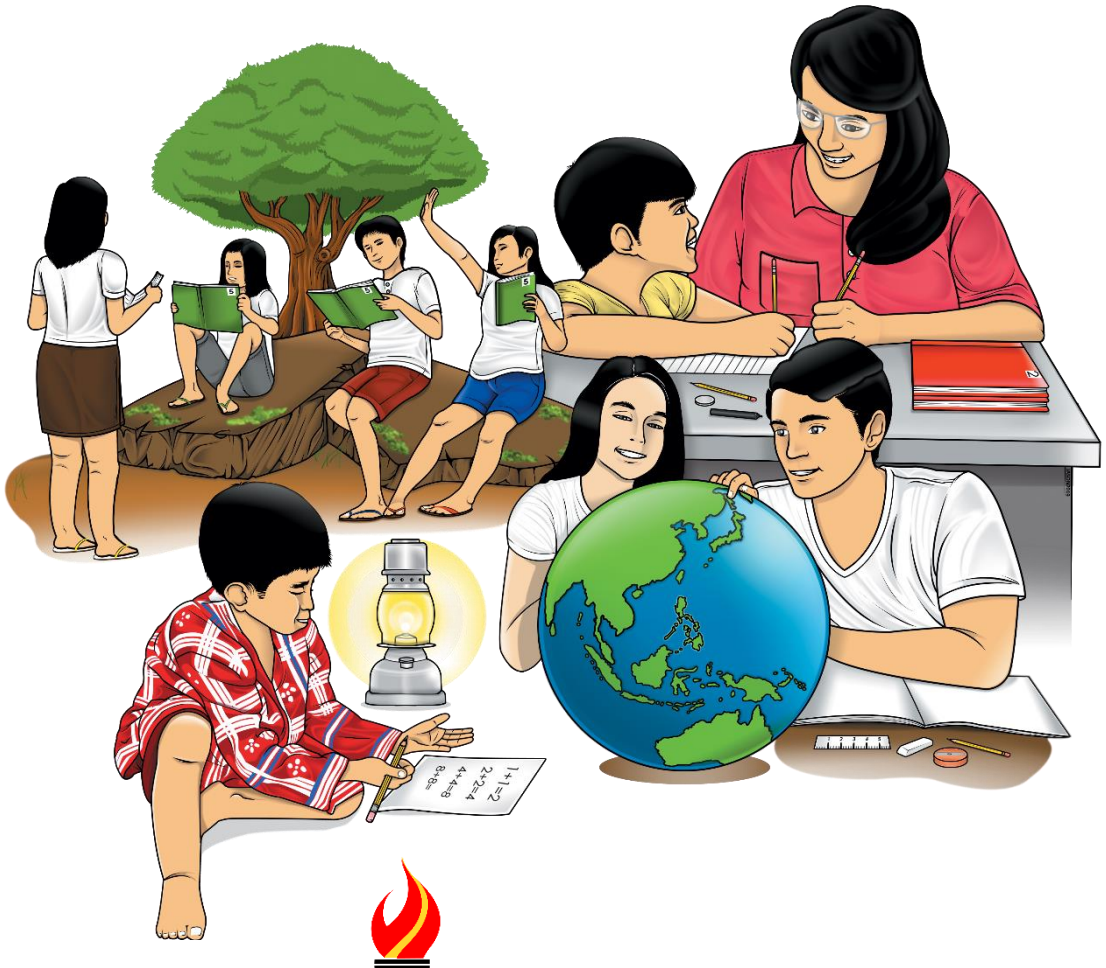
Senior High School

DepED
DEPARTMENT OF EDUCATION

Disaster Readiness and Risk Reduction

Quarter 1 – Module 13: Effects of Different Earthquake Hazards



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ADM

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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.

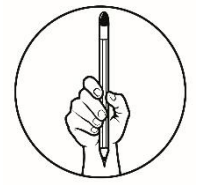
What I Need to Know

In this module, the learner will be able to identify earthquake potential hazards and its effects. It will provide clear concept about ground shaking, ground rupture, tsunami, liquefaction, and earthquake induced landslide and ground subsidence which are the primary effects of earthquake.

This module is intended to equip you with the knowledge of analyzing the effects of the different earthquake hazards.

After going through this module, you are expected to:

a. review the possible effects of an earthquake;
b. appreciate the importance of being ready and resilient; and
c. create a plan for an earthquake awareness program in the community.



What I Know

Before you proceed to study this module, let's find out first how much you already know about the topic.

Directions: Answer the questions below by shading the letter of the best answers on the answer sheet provided.

1. You pass a street, and then you feel the trembling of the ground due to a passing cargo truck. It is also the most familiar effect of earthquake, what is it?
   a. ground rupture c. landslide
   b. ground shaking d. tsunami
2. What is an effect of earthquake when the soil rises to the surface and loses its rigidity for a short time?
   a. fire c. landslide
   b. ground shaking d. liquefaction
3. The strength of ground shaking is measured in terms of the following **except**
   a. accelartion c. frequency
   b. duration d. probability

4. A noticeable rise and fall of _____ is one of the natural signs of an approaching local tsunami.
    a. fire
    b. ground
    c. water pressure
    d. waves
5. If earthquake depends on magnitude, the strength of tsunami depends on_____.
    a. length of tsunami
    b. depth of tsunami
    c. number of waves of tsunami
    d. height of tsunami
6. Your house is near the shoreline, to prevent the hazard caused by tsunami, you should be aware of its signs. Which of the following is **not** a natural sign of impending tsunami?
    a. unusual roaring sound
    b. disappearing ocean water from beach, bay, and river
    c. severe ground shaking
    d. explosive thunderstorm
7. Which of the following instruments is used to detect and record the earthquakes?
    a. anemometer
    b. doppler
    c. seismograph
    d. thermometer
8. A disruptive up-down and sideways movement or motion experienced during an earthquake is called _____.
    a. earthquake induced landslide
    b. ground shaking
    c. liquefaction
    d. tsunami
9. The following are preparedness to do during an earthquake **except**
    a. Stay calm.
    b. Keep on running.
    c. Do the duck, cover and hold.
    d. If outdoors, move away from buildings and streetlights.
10. What is the difference between intensity and magnitude of an earthquake?
    a. There is no difference between intensity and magnitude.
    b. Intensity measures energy while magnitude measures the strength of an earthquake.
    c. Intensity is based on the strength relative to the effect to people or structure while magnitude is based on information derived from instruments.
    d. Intensity is based on information derived from on instruments while magnitude is based on the strength relative to the effect to people or structure.
11. Which of the following statements is **TRUE**?
    a. I should go to the shore to watch a tsunami.
    b. I should stay away from buildings when there is ground shaking.
    c. I should use elevator to escape the building during earthquake.
    d. I should stay near trees and powerlines during ground rupture.

12. A type of ground rupture that there is lateral movement from side to side on the ground is called _____.
    a. Horizonal Displacement
    b. Lateral Displacement
    c. Slant Displacement
    d. Vertical Displacement
13. Earthquakes are common in the Philippines because it is in _____.
    a. Southeast Asia
    b. Pacific Ocean
    c. Pacific Ring of Fire
    d. Earthquake Prone Area
14. Which of the following is **not** an earthquake-induced hazard?
    a. landslide
    b. tsunami
    c. ground displacement
    d. typhoon
15. Who among Jay, Ann, Ruth and Locke did the wrong thing during an earthquake?
    a. Jay is outside. He takes shelter under trees, powerlines and posts.
    b. Ann is in shoreline. She runs away from the shore toward higher ground.
    c. Ruth is inside the building. She uses the stairs to get out.
    d. Locke is inside the car. He avoids crossing the bridges and overpass.

Check your answers on page 23. What score did you get? What did you feel while taking the test? If got a score of 12 and above, you did an awesome job. This indicates that you have a great background about the topics in this module. It is well appreciated that you will still study this module to review what you already know. If your score is 11 and below, don't be upset, this shows that this module is crafted for you. It will help you to understand and apply these concepts in your real life. Are you ready?

You may now go to the next page to begin the new lesson.

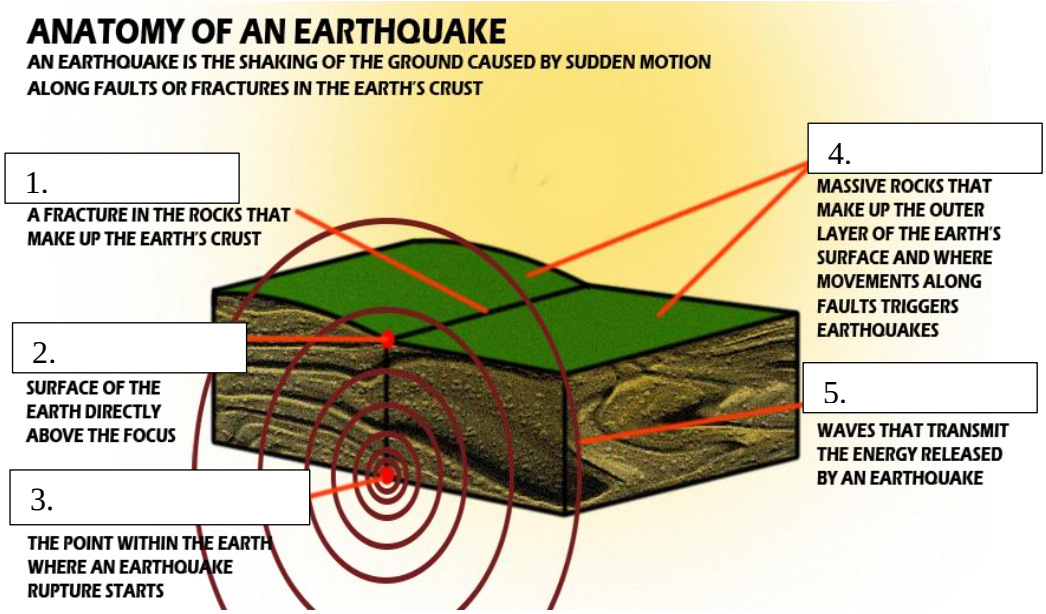
Lesson 1 Effects of Different Earthquake Hazards

What's In

In the previous lesson, you learned the different parts of an earthquake and various potential earthquake hazards. Earthquake is considered as one of geologic hazards. It is a natural phenomenon that can occur in different parts of the world. It is considered as one of the most disastrous phenomena as it can kill thousands of people in a glance. In a record based on United States Geological Survey, the deadliest earthquakes happened last January 23, 1556 at Shensi, China where the magnitude 8 earthquake recorded about 830,000 deaths. On December 26, 2004 at Sumatra, Indonesia, the 9.1 magnitude earthquake recorded about 227,898 deaths, and on January 12, 2010 at Haiti a 7.0 magnitude earthquake recorded about 222,570 deaths. We are always warned by the Department of Science and Technology- Philippines Institute of Volcanology and Seismology (DOST-PHILVOCS) about the possible coming of "The Big One", the question is what are the possible effects of an earthquake once it strikes the country? In this module, you will able to review and analyze the effects of the different earthquake hazards and identify the different earthquake related hazards that can affect your home and/or community.

Activity No 1: Anatomy of an Earthquake

Directions: Label the diagram below, be guided with the definition.



Activity 2: Dangerous Alarm!

Directions: Study the picture. Then read carefully the article and answer the questions below.

Justine was a call center agent. He worked in 24th floor of a huge building located in Makati. Thousands of employees including Justine had an ordinary day doing their jobs. Suddenly, everything changed, the huge building began to rumble and swing. **Alarmed** people headed for the exits. Justine had seen on the television that building started to crack and bridges started to fall. Rivers changed their paths. Mountains and cliffs caused landslides that covered up the houses and roads. Electricity and communication lines were downed. There was also a report that giant waves were seen near seashores that caused floods.

Questions:

1. What did the people feel as described by the word alarmed in the selection?

   _____
   _____
   _____
   _____
   _____

2. What disaster did Justine experience?

   _____
   _____
   _____
   _____
   _____

3. Which of the following were caused by the sudden movement of the ground? (put a check mark to all possible answers)

____landslide ____tornados

____falling rocks/rockslide ____tsunami

____sunburn ____typhoon

____fires from the broken lines ____rivers change their paths

____ buildings and bridges fall

4. What makes an earthquake so dangerous?

_____
_____
_____
_____
_____

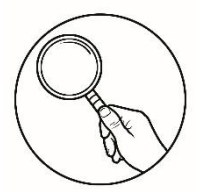
Activity No 3: Let's See

Directions: Study the following pictures taken after an earthquake. In each picture, describe or identify the hazard brought by the earthquake.

No	Picture	Hazards
1	 Source: Retrieved July 11, 2020 from https://pixabay.com/photos/earthquake-rubble-collapse-disaster-1651717/	

2	 Source: Retrieved July 11, 2020, from https://pixabay.com/photos/fire-burning-house-flame-2946038/	
3	 Source: Update on the 10 February 2017 M6.7 Surigao del Norte earthquake (Online Image).n.d., Retrieved July 11, 2020 from https://www.phivolcs.dost.gov.ph/index.php/news/623-update-on-the-10-february-2017-m6-7-surigao-del-norte-earthquake	
4	 Source: Retrieved July 11, 2020, from https://pixabay.com/photos/fantasy-dramatic-tsunami-water-4340503/	

5	 Source: Retrieved July 11, 2020, from https://pixabay.com/photos/rock-slide-eiger-mountain-alps-579765/	



What is It

Potential Earthquake Hazards

1. **Ground Shaking** caused by rapid vibration of the ground. (DOST-PHIVOLCS,N.d.).It is produced by passing of seismic waves beneath the structure that generate sudden slip on the fault. Ground shaking can damage, fall or collapse buildings or structure resulted by shaking of grounds. However, we should keep mind that

Hyatt Terraces Hotel in Baguio City collapsed during the 16 July 1990 Luzon Earthquake.

Source: Hyatt Terraces Hotel (Online Image) n.d., Retirved May 30, 2020, https://www.phivolcs.dost.gov.ph/index.php/earthquake/earthquake-hazards

Ground shaking is measured in terms of the following:

a. velocity
b. acceleration
c. frequency
d. duration

2. **Ground Rupture/ Ground Displacement** is deformation on the ground that marks the intersection of the fault with the earth's surface (DOST-PHIVOLCS,n.d.). Ruptures occur along zones of weakness, such as preexisting faults or fractures. Ground Rupture can cause fissuring, displacement of the ground due to movement of the fault. Specifically, it can cause buildings to collapse, roads to divide and rice fields or irrigation system to displace.

Source: A continuous fault scarp of the North Bohol Fault in Brgy. Anonang, Inabanga, Bohol l (Online Image) n.d., Retirved May 30, 2020 from https://www.phivolcs.dost.gov.ph/index.php/earthquake/earthquake-hazards

Characteristics of Ground Rupture

a. **Length** - It depends on the magnitude of an earthquake. Earthquake with 6.5 magnitudes and above will result to larger rupture.
b. **Width** - The deformation along the length of ground rupture also largely depend on the type of faulting.

Two types of Ground Ruptures

a. **Vertical Displacement**- occurs when one side of the ground goes up or down or both sides move with one side going up and the other going down.
b. **Horizontal Displacement**- happens when there is lateral movement from side to side; one side goes to left or right or both moves sideways in different directions.

Source: Gasoline tank pops out in Dagupan City due to 'liquefaction' (Online Image) n.d. Retrieved May 30, 2020 from https://www.phivolcs.dost.gov.ph/index.php/earthquake/earthquake-hazards

3. **Liquefaction** is a transformation of the behavior of a body of sediments or soil form to liquid form. (DOST-PHIVOLCS,n.d.).It is a process caused by water pressure which makes soil more compact. It decreases the ground's ability to support structures. Liquefaction can cause sinking and/or titling of structure above it; sand boil; fissuring.

Source: Damaged jeep due to tsunami during the 1976 Moro Gulf earthquake *Retrieved May 30, 2020 from https://www.phivolcs.dost.gov.ph/index.php/earthquake/earthquake-hazards*

4. **Tsunami** is a series of waves caused by an earthquake under the sea. (DOST-PHIVOLCS,n.d.). Wave's height could be greater than 5 meters. It is also known as tidal waves. Tsunami can cause flooding, coastal erosion; drowning of people and damage to properties.
A tsunami event in the country happened last August 17, 1976, where a magnitude 7.9 earthquake in Moro Gulf produced up to 9-meter high tsunamis that devastated the southwest coast of Mindanao and left more than 3,000 people dead and at least 1,000 people are missing (DOST-PHIVOLCS,n.d.).

5**. Earthquake-induced landslide** is down slope movements of rocks and other debris commonly triggered by strong shaking. It may include soil, debris, and/ or rocks. (DOST-PHIVOLCS,n.d.). It can cause erosion, burial and blockage of road and rivers.

Source: Rockslide at Brgy. Conalum, Argao, Cebu last October 2013 during 7.2 magnitude Bohol Earthquake. *Retrieved May 30, 2020 from* https://www.phivolcs.dost.gov.ph/index.php/earthquake/earthquake-hazards

6**. Earthquake-Induced ground subsidence** is the sinking or settling of the ground surface due to various causes, such as extraction of ground water and natural gas, mining and earthquakes (DOST-PHIVOLCS, n.d.).It can caused ground subsides; the structures on the surface can tilt or collapse due to weakened foundation.

What's More

Activity No 4: Earthquake Experience

Direction:

A. **Students with internet access**. Search from the internet for any article/ material about a major earthquake occurrence in your area or nearby areas
B. **Students with no internet access**. Choose any of the following option
   i. Interview
      - Ask an adult in your family or anyone in your neighborhood about his/her experiences on earthquakes.
   ii. Newspaper Clippings
      - Copy or cut-out any news article about earthquakes. Gather all possible information from the news article.

Write a summary of your interview or research; be guided with the following questions.

Questions:

1. When did this earthquake happen? Date and Time (if possible). What were the magnitude, intensity and epicenter location (if possible)?
2. What did you feel during the earthquake?
3. What did you do during the earthquake?
4. What did you do after the earthquake?
5. What were the effects of the earthquake based on your experience?
6. Why were these earthquake events remarkable?

Activity No 5: Think about this!

I. Directions: Analyze the scenario, then answer the questions below.

Close your eyes and imagine that where you are right now, you are experiencing an intense shaking.

1. What will happen to the objects around you? Could these items be potential hazards?

   _____
   _____

2. What would be the reactions and responses of other people in your area to the initial shaking?

   _____
   _____

3. What will you do once the earthquake stops?

   _____
   _____

4. What are some problems after the earthquake that you may encounter? What have been damaged brought by the earthquake?

   _____
   _____

5. What will you need and do to fix these problems?

   _____
   _____

6. Is there a way to prevent future earthquake damage? How?

   _____
   _____

II. Directions: Analyze the scenario, then answer the questions below.

Barangay Magkaisa offers a free training for two families about how to make a Family Preparedness Plan and Earthquake Drill. This is how they respond to the offer of the barangay.

Family 1: Reyes family actively participate in the training.
Family 2: Cruz family refuses to attend the training.
…. If one night, an earthquake strikes their city.

Questions:

1. Which one of the two families would likely to experience less casualties during the earthquake? Why??

_____
_____
_____
_____
_____
_____
_____

2. What are the importance of participating in barangay activities?

_____
_____
_____
_____
_____
_____
_____

III. Directions: For each earthquake hazard, name three possible effects to structure and mankind

Earthquake Hazard	Effects on structure and mankind
1. Ground rupture	a. _____ b. _____ c. _____
2. Ground shaking	a. _____ b. _____ c. _____
3. Liquefaction	a. _____ b. _____ c. _____
4. Tsunami	a. _____ b. _____ c. _____
5. Earthquake-induced landslide-	a. _____ b. _____ c. _____
6. Earthquake-Induced ground subsidence	a. _____ b. _____ c. _____

Questions:

1. What are the harmful effects of an earthquake?

   _____
   _____
   _____

2. How do earthquakes affect human life?

   _____
   _____
   _____

3. How do we lessen the effects of these earthquake hazards?

   _____
   _____
   _____

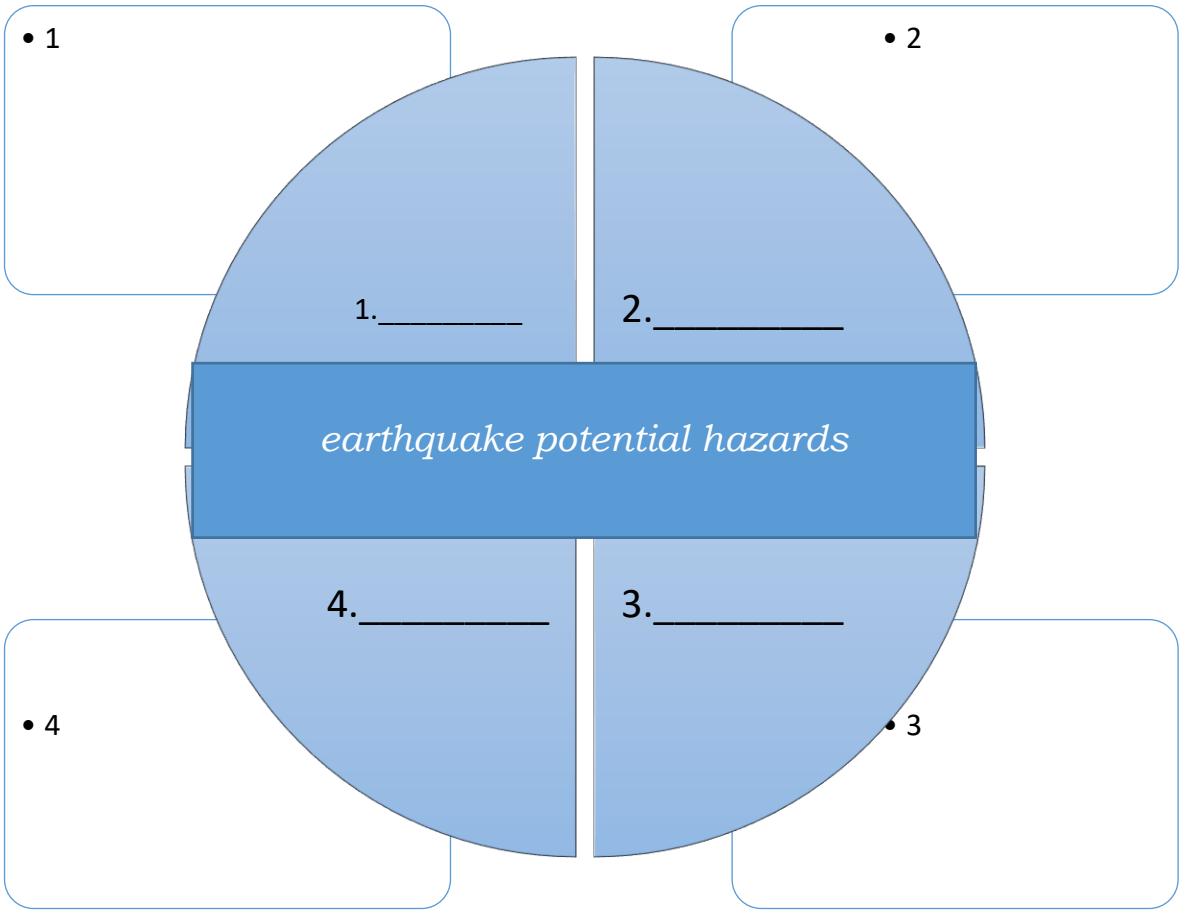
Activity No 6: An Investigation: Earthquake Hazards in a Local Area

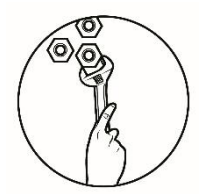
Directions: Complete the table below with the appropriate needed information. As your reference, go around your house or you base your answer on your prior knowledge about the vicinity of the community. Identify unsafe areas or hazards that may lead to accidents when an earthquake strikes. Write specific descriptions of unsafe areas.

Unsafe Areas **Descriptions for Being Unsafe**	**Observations**	**Why it is unsafe?**
Example: Electricity lines and street lights	Electricity lines are not properly installed and have weak foundation. It can fall and cause fire when an earthquake strike.	It can fall and caused fire when an earthquake strike.
1.		
2.		
3.		
4.		
5.		

What I Have Learned

Directions: Fill-in the graphic organizer below with the appropriate needed information. In the inner circle, name and define 4 earthquake potential hazards. Then fill-in with the effects of each hazard in the outer squares.





What I Can Do

Activity No 7: Let's Try This: Community Preparation for Earthquakes

Directions: The National Disaster Risk Reduction and Management Council (NDRRMC) always conducts a Nationwide Earthquake Drill. This drill is being conducted simultaneously in schools, establishments, government, and non-government offices. Create and design a program in your community which aims to teach the residents what to do before, during and after an earthquake based on the set preparedness guide issued by NDRRMC and PHIVOLCS.

I. Title of the Program

II. Objectives

III. List of Activities

Assessment

Directions: Read carefully the questions below. Choose and write the letter of the correct answer in your answer sheet.

1. The following are earthquake hazards **except** _____
   a. ground rupture
   b. ground shaking
   c. landslide
   d. pollution

2. During the earthquake, it is the preceived strenght of an earthquake based on realtive effect to people and structures; generally higher strenght near the epicenter.
   a. intensity
   b. level
   c. magnitude
   d. strength

3. Which of the following is **not** a term to describe the strength of ground shaking?
   a. accelartion
   b. duration
   c. frquency
   d. probability

4. A noticeable rise and fall of waves are one of the natural sign of an approaching _____.
   a. earthquake
   b. landslide
   c. thunderstorm
   d. tsunami

5. If the strength of tsunami depends on height of tsunami, an earthquake depends on _____
   a. intensity
   b. level
   c. magnitude
   d. strength

6. If you observed the warning signs of a tsunami, which of the following should you do?
    a. do the duck, cover and hold
    b. move quickly to higher ground
    c. stay on place while watching the waves
    d. wait for ocean water to disappear

7. It is a tool used to identify the areas where specific earthquake hazards are likely to happen and the expected severity it may cause on that area?
    a. anemometer
    b. doppler
    c. seismograph
    d. thermometer

8. A fracture on which one body of rocks slide then past another is called_____.
    a. bedrock
    b. fault
    c. magma
    d. strength

9.The following are earthquake hazards the can be prevented during an earthquake **except**_____.
    a. ground rupture
    b. ground shaking
    c. liquefaction
    d. tsunami

10. It refers to the disruptive up-down and sideways movement or motion experienced during an earthquake.
    a. ground rupture
    b. ground shaking
    c. liquefaction
    d. tsunami

11. _____ measures energy while _____ measures the strength of an earthquake.
    a. Ground rupture, ground shaking
    b. Ground shaking, round rupture,
    c. Intensity, magnitude
    d. Magnitude, intensity

12. Valley Fault system's areas are at high risk of which earthquake hazard?
    a. ground sinkhole
    b. ground shaking
    c. ground rupture
    d. tsunami

13. The following are earthquake-induced hazard, except _____
    a. landslide
    b. tsunami
    c. ground displacement
    d. typhoon

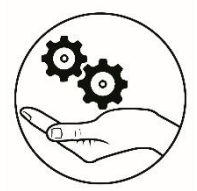
14. Who among Ken, Khiara and Kevin did the right thing during an earthquake?
    I. Ken is inside his condo building. He uses the stairs to get out.
    II. Khiara is in the beach. When she hears the tsunami alert she immediately runs away from the shore toward higher ground.
    III. Kevin is inside the car. He crosses the bridges and overpass.

    a. I only
    b. I and II only
    c. II and III only
    d. I, II and III

15. You are at the beach with your family, which of the following is a good practice in an event of tsunami?
    I. If the tsunami occurs, you should invite your family member near the shore to witness together this once in a lifetime event.
    II. If tsunami occurs in the beach get a floating object, then stay on the water.
    III. If you are swimming with your family, and you hear the tsunami alarm, immediately leave the water and go to the higher ground.
    a. I only
    b. I and II only
    c. II and III only
    d. I, II and III

Take your time ☺

Compare your answers with the Answer Key found on page 23. If your score is 7 or above, well done! You have learned about the different effects of an earthquake. You may already proceed to the next lesson. If your score is 6 or below, you need to review this lesson before proceeding to the next lesson.



Additional Activities

Directions: A. The Philippines is situated in a tectonically active region called **"Pacific Ring of Fire"** where numerous earthquakes occur. An average of 20 earthquakes are recorded daily in the country. However, most of these are unfelt and can only be detected by an instrument called SEISMOGRAPH. As a disaster response and recovery advocate, what are the things that you can contribute to possibly minimize risk of disaster caused by earthquake in your home and in school.

_____

_____

_____

_____

_____

_____

_____

_____

B. Write a short descriptive essay of 10-15 sentences describing yourself on *"Being Ready and Resilient".* Be guided with the given Rubric.

_____

_____

_____

_____

_____

_____

_____

_____

Answer Key

What's In

Activity No :1

1.SEISMIC WAVES,
2. FOCUS,
3. PLATES,
4. EPICENTER,
5. FAULT

What's New

Activity No 3

1. The church collapsed.
2. The buildings/houses were burnt.
3. The grounds were ruptured and displaced.
4. Lands were liquefied.
5. Landslide happened.

What I Know

1. B	10. C
2. D	11. B
3. D	12. A
4. D	13. C
5. D	14. D
6. D	15. A
7. C	
8. B	
9. B	

Assessment

1. D	10. A
2. A	11. C
3. B	12. C
4. D	13. D
5. C	14. B
6. D	15. A
7. C	
8. B	
9. B	

What's New

Activity No 2

1. The people felt afraid and scared.
2. Earthquake
3. Landslide, falling rocks, fires, buildings and bridges fall, tsunami and rivers change their path.
4. It can cause large damage to properties and lives.

What's More

Activity 5 and 6, answers may vary

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