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DISASTER READINES AND RISK REDUCTION

Level: SENIOR HIGH SCHOOL
Subject Group: CORE SUBJECT
Semester: FIRST
Quarter: FIRST

Course Description:
This course focuses on the application of scientific knowledge and the solution of practical problems in a physical environment. It is designed to bridge the gap between theoretical science and daily living.

Course Requirements:
Below are the list of activities that must be completed and submitted.

WEEK	ACTIVITIES	Date of Completion	Raw Score	Final Grade
1	Enabling Assessment Activity No. 1 –		30	
2	Performance Check No. 1 –		30	
3	Enabling Assessment Activity No. 2 –		30	
4	Performance Check No. 2 –		30	
5	Enabling Assessment Activity No. 3 –		30	
6	Performance Check No. 3 –		30	
7	Enabling Assessment Activity No. 4 –		30	
8	Performance Check No. 4 –		50	
		TOTAL	260	

Grading System (DRRR)

QUARTER 1	
Performance Check	50%
Enabling Assessment Activity	30%
Quarterly Examination	20%
FIRST QUARTERLY GRADE TOTAL	**100%**

PRE-REQUISITE ASSESSMENT
Why is Earth Science or Earth and Life Science a pre-requisite course for Disaster Readiness and Risk Reduction?

Weeks 1-2: Basic Concept of Disaster and Disaster Risk

***LEARNING MATERIALS*:** Module, pen, paper, old earth science books, internet (if applicable)
PRE-REQUISITE CONTENT KNOWLEDGE: Basic concepts on Earth Science
PRE-REQUISITE SKILL: Basic knowledge on Subsystems of Earth

TIME ALLOTMENT: 8 HRS
CONSULTATION: For inquiries and clarifications regarding the lesson, you may contact your teacher thru his FB Messenger or thru email

RUA: *At the end of the lesson, you should be able to:*
Explain the meaning of disaster
Differentiate the risk factors underlying disasters
Describe the effects of disasters on one's life
Analyze disaster from the different perspectives (physical, psychological, socio-cultural, economic, political, and biological).

INSTITUTIONAL VALUES*: Environmental Awareness, Social Responsibility*
Students will be able to apply
a. Environmental awareness on the natural disasters happening in the community
b. Social Responsibility on disseminating information about disaster

OVERVIEW OF THE LESSON
This lesson is all about meaning of disaster, its risk factors and effects to the community.

STUDENT'S EXPERIENTIAL LEARING

Disaster readiness and the Red Cross and Red Crescent Movement.
The purpose of the International Red Cross and Red Crescent Movement, as embodied in its Constitution and the principle of humanity, is to prevent and alleviate human suffering wherever it may be found, to protect life and health and ensure respect for the human being. Disaster preparedness fits within this overarching purpose and has been identified in IFRC's (International Federation of Red Cross and Red Crescent Societies) Strategy 2010, as one of the "core areas" that National Societies should prioritize and integrate into their overall programming efforts.

IFRC Headquarters located in Geneva, Switzerland

Aims and objectives of disaster preparedness

Disaster preparedness (readiness) refers to measures taken to prepare for and reduce the effects of disasters. That is, to predict and—where possible—prevent them, mitigate their impact on vulnerable populations, and respond to and effectively cope with their consequences.

Disaster preparedness is best viewed from a broad perspective and is more appropriately conceived of as a goal, rather than as a specialized program or stage that immediately precedes disaster response. Disaster preparedness is a continuous and integrated process resulting from a wide range of activities and resources rather than from a distinct sectoral activity by itself. It requires the contributions of many different areas—ranging from training and logistics, to health care to institutional development.

Viewed from this broad perspective, disaster preparedness encompasses the following objectives:

• Increasing the efficiency, effectiveness and impact of disaster emergency response mechanisms at the community, national and Federation level.

• Strengthening community-based disaster preparedness through National Society programs for the community or through direct support of the community's own activity.

• Developing activities that are useful for both addressing everyday risks that communities face and for responding to disaster situations—for example, health, first aid or social welfare programs that have components useful for disaster reduction and response.

Effect of Typhoon Agaton in Capiz on January, 2022.

Disaster - A serious disruption of the functioning of a community or a society involving widespread human, material, economic, or environmental losses and impacts which exceeds the ability of the affected community or society to cope using its own resources.

Natural hazards are naturally occurring physical phenomena caused either by rapid or slow onset events which can be geophysical, hydrological climatological meteorological or biological

Technological or man-made hazards are events that are caused by humans and occur in or close to human settlements. This can include environmental degradation, pollution and accidents.

Disaster Risk factors are variables that either aggravate or mitigate the effects of hazards, affecting the degree or scope of a disaster.

Disaster Risk Factors

(1) Physical factors would pertain to tangible objects or infrastructure, like the availability of fire exits, or the sturdiness of the building, or the presence or absence of objects that can harm you or help you, etc.
(2) Psychological factors include state of mental capacity and health (e.g. are we dealing with babies? Kids? Adults? People with special needs?), perception of self (e.g. self-assessment of capability to respond to disasters, fear), etc.
(3) Socio-cultural factors include religion, social status, traditions, perception by society, etc.
(4) Economic factors include assets and liabilities, income, economic class, etc.
(5) Political factors include government structure, diplomatic issues, etc.
(6) Biological factors include flora and fauna in environment, health, diseases, etc.

An Increase in Natural Disasters

According to a November 2015 report from the United Nations, the rate of weather-related disasters (such as cyclones, typhoons and droughts) is growing. Between 2005 and 2014, the annual average of weather-related disasters was 335, an increase of 14 percent from 1995 to 2004 and almost twice the average recorded from 1985 to 1995. In the past 20 years, 90 percent of major disasters have been caused by 6,457 recorded floods, storms, heat waves, droughts and other weather events. Indonesia, India and the Philippines are among the five countries hit by the highest number of disasters, besides the United States and China.

Why Are Developing Countries More Vulnerable to Natural Disasters?

Developed countries are better prepared to handle the impact of disasters as well as the aftermath. In developing nations, natural disasters trap people in a cycle of poverty because they do not have the resources to rebuild their homes and meet other basic needs, making them less able to recover in the long run.
Certain factors present in poverty environments will turn a natural hazard into a disaster:

- Poorly constructed buildings
- Poor sanitation
- Rapid population growth/high density population
- Limited resources for disaster response and rebuilding
- Lack of economic safety nets

RUA OF A STUDENT'S LEARNING

Week 1 ANSWER SHEET *(Please submit only the answers. Do not return the entire module.)*

Name: _____Section: _____
LAST NAME, FIRST NAME MIDDLE INITIAL

Enabling Assessment Activity No.1. HAZARDS

Describe the effects of disasters in your life and include the following hazards you have experienced. (10 points)

_____

_____

_____

1. Ground shaking
2. Tornado
3. Landslide
4. Flood
5. Indoor fire
6. Lava flow
7. Industrial pollution
8. Typhoon
9. Forest fire
10. Liquefaction
11. Storm surge
12. Tsunami
13. Extreme rainfall

ASSIMILATION

1. According to World Risk Index 2023, Philippines remains the most at-risk country since 2011. Explain why Philippines remain at that spot. (10 pts)

2. According to World Risk Index 2023, Singapore is one of the safest countries around the world. What do you think is their solutions to disaster-related problems? (10 pts)

RUA OF A STUDENT'S LEARNING

Week 2 ANSWER SHEET *(Please submit only the answers. Do not return the entire module.)*

Name: _____ **Section:** _____
LAST NAME, FIRST NAME MIDDLE INITIAL

Performance Check No.1. RISK FACTORS

How did the recent typhoon personally affected you using the risk factors below? (30 pts)

RISK FACTORS	PERSONAL EXPERIENCE
Physical	
Psychological	
Socio-cultural	
Economic	
Political	
Biological	

PRE-REQUISITE ASSESSMENT
Why is sickness due to COVID-19 not considered as a Physical Factor?

Weeks 3-4: Hazard, Exposure and Vulnerabilities

***LEARNING MATERIALS*:** Module, pen, paper, old earth science books, internet (if applicable)
PRE-REQUISITE CONTENT KNOWLEDGE: Basic concepts on Disaster
PRE-REQUISITE SKILL: Basic knowledge on identifying effects of disaster

TIME ALLOTMENT: 8 HRS
CONSULTATION: For inquiries and clarifications regarding the lesson, you may contact your teacher thru his FB Messenger or thru email

RUA: *At the end of the lesson, you should be able to:*

Explain the meaning of vulnerability
Explain why certain sectors of society are more are more vulnerable to disaster than others
Recognize vulnerabilities of different elements exposed to specific hazards
Differentiate among hazards, exposure, and vulnerabilities and give examples from actual situations

INSTITUTIONAL VALUES*: Environmental Awareness, Social Responsibility*
Students will be able to apply

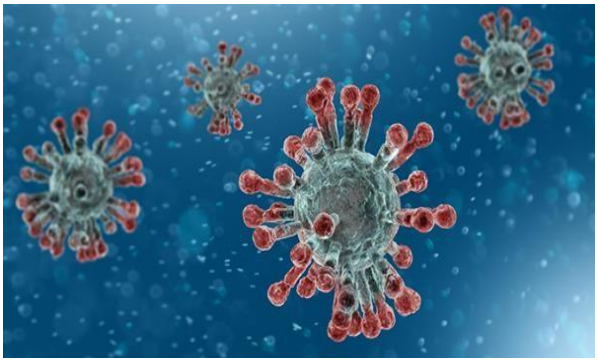
a. Environmental awareness on the effect of hazard and exposure to a particular disaster in a community
b. Social Responsibility on recognizing possible vulnerabilities when exposed to a particular risk or hazard

OVERVIEW OF THE LESSON
This lesson is all about hazard and exposure, its effect to a particular group of individuals in a community and vulnerabilities that may encounter in the society

STUDENT'S EXPERIENTIAL LEARNING

Natural hazards are naturally occurring physical phenomena caused either by rapid or slow onset events which can be
*geophysical (earthquakes, landslides, tsunamis and volcanic activity),
*hydrological (avalanches and floods), climatological (extreme temperatures, drought and wildfires),
*meteorological (cyclones and storms/wave surges) or
*biological (disease epidemics and insect/animal plagues).

Technological or man-made hazards (complex emergencies/conflicts, famine, displaced populations, industrial accidents and transport accidents) are events that are caused by humans and occur in or close to human settlements. This can include environmental degradation, pollution and accidents.



Examples of **biological hazards** include outbreaks of epidemic diseases, plant or animal contagion, insect or other animal plagues and infestations.
(Image of Wuhan Corona Novel Coronavirus (COVID-19))

Geological hazards include internal earth processes, such as earthquakes, volcanic activity and emissions, and related geophysical processes such as mass movements, landslides, rockslides, surface collapses, and debris or mudflows. Hydrometeorological factors are important contributors to some of these processes. Tsunamis are difficult to categorize; although they are triggered by undersea earthquakes and other geological events, they are essentially an oceanic process that is manifested as a coastal water-related hazard.

Hydrometeorological hazards include tropical cyclones (also known as typhoons and hurricanes), thunderstorms, hailstorms, tornados, blizzards, heavy snowfall, avalanches, coastal storm surges, floods including flash floods, drought, heatwaves and cold spells. Hydrometeorological conditions also can be a
factor in other hazards such as landslides, wildland fires, locust plagues, epidemics, and in the transport and dispersal of toxic substances and volcanic eruption material.

Vulnerability describes the characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard.
There are many aspects of vulnerability, arising from various physical, social, economic, and environmental factors.
Examples may include:

- poor design and construction of buildings,
- inadequate protection of assets,
- lack of public information and awareness,
- limited official recognition of risks and preparedness measures, and
- disregard for wise environmental management.

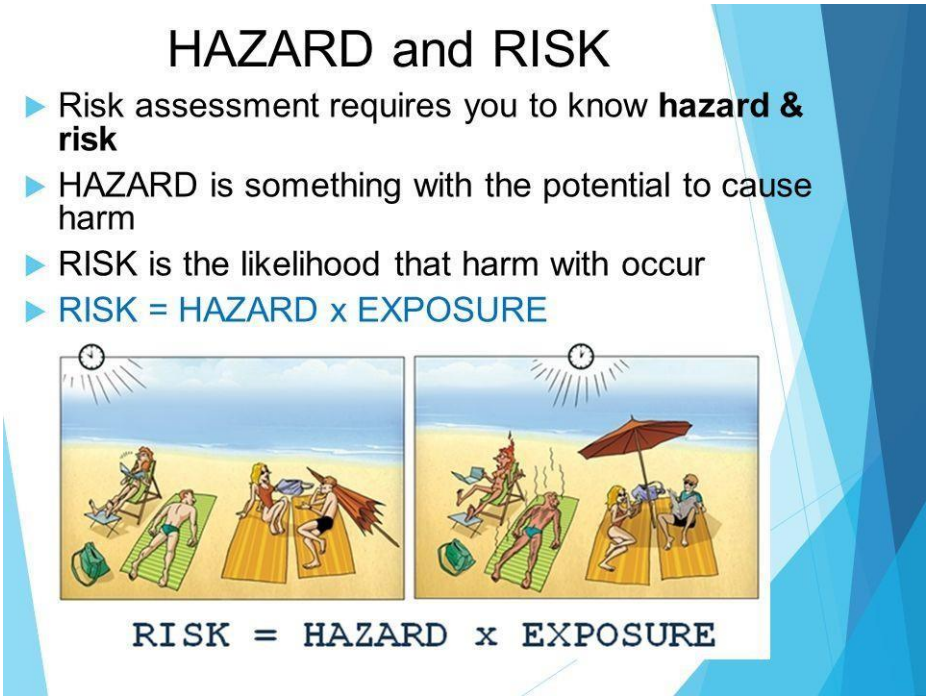
Effect of Typhoon Yolanda (November 2013) in Leyte

Vulnerability varies significantly within a community and over time. This definition identifies vulnerability as a characteristic of the element of interest (community, system or asset) which is independent of its exposure. However, in common use the word is often used more broadly to include the element's exposure. The above explanation was taken from the United Nations (UN) International Strategy for Disaster Reduction (ISDR) Terminology on Disaster Risk Reduction.
There are four (4) main types of vulnerability:
1. Physical Vulnerability may be determined by aspects such as population density levels, remoteness of a settlement, the site, design and materials used for critical infrastructure and for housing (UNISDR).
Example: Wooden homes are less likely to collapse in an earthquake, but are more vulnerable to fire.
2. Social Vulnerability refers to the inability of people, organizations and societies to withstand adverse impacts to hazards due to characteristics inherent in social interactions, institutions and systems of cultural values. It is linked to the level of well-being of individuals, communities

and society. It includes aspects related to levels of literacy and education, the existence of peace and security, access to basic human rights, systems of good governance, social equity, positive traditional values, customs and ideological beliefs and overall collective organizational systems (UNISDR).
Example: When flooding occurs some citizens, such as children, elderly and differently-able, may be unable to protect themselves or evacuate if necessary.
3. Economic Vulnerability. The level of vulnerability is highly dependent upon the economic status of individuals, communities and nations. The poor are usually more vulnerable to disasters because they lack the resources to build sturdy structures and put other engineering measures in place to protect themselves from being negatively impacted by disasters.
Example: Poorer families may live in squatter settlements because they cannot afford to live in safer (more expensive) areas.
4. Environmental Vulnerability. Natural resource depletion and resource degradation are key aspects of environmental vulnerability. Example: Wetlands, such as the Caroni Swamp, are sensitive to increasing salinity from sea water, and pollution from storm water runoff containing agricultural chemicals, eroded soils, etc.

What is Risk?
Risk (or more specifically, disaster risk) is the potential disaster losses (in terms of lives, health status, livelihoods, assets and services) which could occur to a particular community or a society over some specified future time period. (Reference UNISDR Terminology) It considers the probability of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environmentally damaged) resulting from interactions between natural or human induced hazards and vulnerable conditions.

There are different ways of dealing with risk, such as:
Risk Acceptance: an informed decision to accept the possible consequences and likelihood of a particular risk.
Risk Avoidance: an informed decision to avoid involvement in activities leading to risk realization.
Risk Reduction refers to the application of appropriate techniques to reduce the likelihood of risk occurrence and its consequences.
Risk Transfer involves shifting of the burden of risk to another party. One of the most common forms of risk transfer is Insurance.



RUA OF A STUDENT'S LEARNING

Week 3 ANSWER SHEET *(Please submit only the answers. Do not return the entire module.)*

Name: _____Section: _____
LAST NAME, FIRST NAME MIDDLE INITIAL

Enabling Assessment Activity No.2. MANAGING RISKS

Identify whether the given situation is an Exposure (E), Vulnerability (V) or Capacity (C).

Write the letter of your answer (7 pts).

1. Japanese invented the "Japanese house" which can sway and move during earthquake.

2. Colegio de Los Banos provided fire extinguisher on designated areas.

3. A household is composed of two senior citizens and two minor grandchildren.

4. Philippines is located in the Pacific Ring of Fire where 90% of the volcanoes in the world are located.

5. Cruz family has many relatives living outside the community.

6. A Tagalog lady in Davao City.

7. People are going outside to go to "Dolomite Beach" and physical distancing is not being observed.

ASSIMILATION.

Refer to the image below:

1. Explain the vulnerabilities involved in this photo.

2. How do you manage the risks associated with it? Use the risk management procedures: Risk Acceptance, Risk Avoidance, Risk Reduction, and Risk Transfer.

_____
SIGNATURE OVER PRINTED NAME OF PARENT/GUARDIAN
DATE: _____

RUA OF A STUDENT'S LEARNING

Week 4 ANSWER SHEET *(Please submit only the answers. Do not return the entire module.)*

Name: _____ **Section:** _____
LAST NAME, FIRST NAME MIDDLE INITIAL

Performance Check No.2. IMPACTS OF HAZARDS

Provide the impact of hazards on different scenarios and locations by acting it out inside the classroom. (30 pts)

Hazards:
1. Typhoon (strong winds and heavy rain)
2. Earthquake
3. Indoor Fire

Location and Scenario:
1. Family inside a concrete house
2. Hikers going up a mountain
3.Group of friends in an isolated beach
4. Students living beside or near the river
5. Group of workers stuck inside an elevator

Rubric

Criteria	Excellent (4)	Good (3)	Fair (2)	Needs Improvement (1)
Understanding of Theme	Demonstrates a thorough understanding of the theme and incorporates it seamlessly into the performance.	Shows a good understanding of the theme and mostly integrates it into the performance.	Displays some understanding of the theme but with partial integration into the performance.	Shows little to no understanding of the theme with minimal or no integration into the performance.
Characterization	Characters are well-developed and convincingly portrayed with strong, consistent characterization.	Characters are developed and generally well-portrayed with consistent characterization.	Characters are somewhat developed but may lack depth or consistency in portrayal.	Characters are underdeveloped and poorly portrayed, lacking consistency and depth.
Dialogue	Dialogue is clear, engaging, and effectively conveys the characters and story.	Dialogue is clear and generally effective in conveying the characters and story.	Dialogue is somewhat clear but may be less engaging or less effective in conveying the story.	Dialogue is unclear, unengaging, and ineffective in conveying the characters and story.
Creativity	Demonstrates high creativity with original ideas, innovative approaches, and effective use of dramatic elements.	Shows good creativity with some original ideas and effective use of dramatic elements.	Displays some creativity, but relies on common ideas with limited use of dramatic elements.	Lacks creativity, with few original ideas and minimal use of dramatic elements.
Collaboration	Excellent teamwork; all members contribute significantly and effectively.	Good teamwork; most members contribute effectively.	Fair teamwork; some members contribute more than others.	Poor teamwork; few members contribute effectively, with minimal collaboration.

Delivery & Presence	Exceptional delivery with strong voice projection, clear articulation, and engaging stage presence.	Good delivery with clear voice projection and articulation, and good stage presence.	Fair delivery with occasional issues in voice projection, articulation, or stage presence.	Weak delivery with poor voice projection, unclear articulation, and minimal stage presence.
Use of Props/Costumes	Highly effective and creative use of props and costumes that enhance the performance.	Effective use of props and costumes that generally enhance the performance.	Some use of props and costumes, though they may not significantly enhance the performance.	Little to no use of props and costumes, or they are ineffective in enhancing the performance.
Audience Engagement	Fully engages the audience, maintaining their interest throughout the performance.	Generally engages the audience, maintaining their interest most of the time.	Occasionally engages the audience, but may lose their interest at times.	Rarely engages the audience, failing to maintain their interest.

Scoring
28-32 points: Outstanding Performance
20-27 points: Proficient Performance
12-19 points: Basic Performance
8-11 points: Needs Improvement

PRE-REQUISITE ASSESSMENT

Is an earthquake considered RISK or HAZARD? Justify your answer

Week 5-6: Earthquake Hazards

***LEARNING MATERIALS*:** Module, pen, paper, old earth science books, internet (if applicable)
PRE-REQUISITE CONTENT KNOWLEDGE: Hazard
PRE-REQUISITE SKILL: Basic knowledge on identifying effect of a particular hazard

TIME ALLOTMENT: 8 HRS
CONSULTATION: For inquiries and clarifications regarding the lesson, you may contact your teacher thru his FB Messenger or thru email

RUA: *At the end of the lesson, you should be able to:*

Identify various potential earthquake hazards
Recognize the natural signs of an impending tsunami;
Analyze the effects of the different earthquake hazards
Interpret different earthquake hazard maps

INSTITUTIONAL VALUES*: Technological Literacy, Environmental Awareness, Social Responsibility*

Students will be able to apply

a. Technological literacy on identifying signs of an impending earthquake
b. Environmental awareness on the various potential hazards of earthquake
c. Social Responsibility on recognizing the effects of earthquake hazards

OVERVIEW OF THE LESSON

This lesson is all about earthquake hazards, the dangers and effects of earthquake hazards, as well as signs of an impending earthquake and basic knowledge on interpreting a hazard map

STUDENT'S EXPERIENTIAL LEARNING

An earthquake is a feeble shaking to violent trembling of the ground produced by the sudden displacement of rocks or rock materials below the earth's surface. There are two types of earthquakes: tectonic and volcanic earthquakes. Tectonic earthquakes are those generated by the sudden displacement along faults in the solid and rigid layer of the earth. Earthquakes induced by rising lava or magma beneath active volcanoes are called volcanic earthquakes.

(Image of Chocolate Hills destroyed by a 7.2 magnitude earthquake in Bohol, 2013. The Bohol Earthquake is said to be one of the 5 most destructive earthquake in Philippine History)

Fault- refers to a fracture, fissure or a zone of weakness where movement or displacement has occurred or may occur again; a fault is said to be “active fault” if it has historical and contemporary seismicity, has evidence of fault slip based on displaced rocks or soil units of known age and displaced landforms; an active fault is defined as a fault which has moved within the last 10,000 years

Potential Earthquake Hazards
I. Ground shaking- disruptive up-down and sideways movement or motion experienced during an earthquake
II. Ground rupture- displacement on the ground due to movement of fault
III. Tsunami- sea waves resulting from the disturbance of ocean floor by an earthquake
IV. Liquefaction- is a process that transforms the behavior of a body of sediments from that of a solid to that of a liquid when subjected to extremely intense shaking
V. Earthquake-induced landslide- failures in steep or hilly slopes triggered by an earthquake

Natural Signs of an Impending Tsunami
I. Feel an earthquake. If the ground shakes under your feet in a coastal region, a tsunami may have been caused by a strong undersea earthquake. However, you may not feel an earthquake if the event is far away.
II. Ocean water disappear from the beach, bay or river Before a tsunami arrives, water may recede from the shoreline before returning as a fast-moving wall of water. If you notice the water is disappearing, tell your family and friends and prepare to move inland or to higher ground.
III. Hear an unusual roaring sound If you hear a loud roar approaching (a bit like a passenger jet or a train), tell your family and friends. It could be a tsunami approaching.

*****The biggest tsunami in the history occurred in Lituya Bay, Alaska on the night of July 9, 1958. The said tsunami has a recorded height of 1720 feet.

Magnitude of an earthquake refers to the amount of energy released, measured by the amount of ground displacement or shaking. It is calculated based on record of the earthquake (seismograph). It is represented by Arabic numbers (ex. 4.8, 9.0)

*The highest recorded earthquake in the world is 9.5 occurred on May 22, 1960 near Valdivia, Southern Chile. Also called the “Great Chilean Earthquake”
*The deadliest recorded earthquake in the Philippines occurred in Moro Gulf on August 4, 1976 with a magnitude of 7.9. It was reported that 4,791 died on the earthquake, 2,288 were missing and 9,928 were injured.

Intensity is the strength of an earthquake as perceived and felt by people in a certain locality. It is a numerical rating based on relative effects to people, objects, environment and structures in the surroundings. The intensity is generally higher near the epicenter. It is represented by Roman Numerals (ex. II, IV, IX)

*The highest magnitude of earthquake recorded in the Philippines has an intensity of 8.3 in August 15, 1918 called the Celebes Sea Earthquake (Intensity X, Extreme)

PHIVOLCS Earthquake Intensity Scale (PEIS)

I- **Scarcely Perceptible** - Perceptible to people under favorable circumstances. Delicately balanced objects are disturbed slightly. Still Water in containers oscillates slowly.

II- **Slightly Felt** - Felt by few individuals at rest indoors. Hanging objects swing slightly. Still Water in containers oscillates noticeably.

III- Weak - Felt by many people indoors especially in upper floors of buildings. Vibration is felt like one passing of a light truck. Dizziness and nausea are experienced by some people. Hanging objects swing moderately. Still water in containers oscillates moderately.

IV- Moderately Strong - Felt generally by people indoors and by some people outdoors. Light sleepers are awakened. Vibration is felt like a passing of heavy truck. Hanging objects swing considerably. Dinner, plates, glasses, windows and doors rattle. Floors and walls of wood framed buildings creak. Standing motor cars may rock slightly. Liquids in containers are slightly disturbed. Water in containers oscillate strongly. Rumbling sound may sometimes be heard.

V- Strong - Generally felt by most people indoors and outdoors. Many sleeping people are awakened. Some are frightened, some run outdoors. Strong shaking and rocking felt throughout building. Hanging objects swing violently. Dining utensils clatter and clink; some are broken. Small, light and unstable objects may fall or overturn. Liquids spill from filled open containers. Standing vehicles rock noticeably. Shaking of leaves and twigs of trees are noticeable.

VI-Very Strong - Many people are frightened; many run outdoors. Some people lose their balance. motorists feel like driving in flat tires. Heavy objects or furniture move or may be shifted. Small church bells may ring. Wall plaster may crack. Very old or poorly built houses and manmade
structures are slightly damaged though well-built structures are not affected. Limited rockfalls and rolling boulders occur in hilly to mountainous areas and escarpments. Trees are noticeably shaken.

VII-Destructive - Most people are frightened and run outdoors. People find it difficult to stand in upper floors. Heavy objects and furniture overturn or topple. Big church bells may ring. Old or poorly-built structures suffer considerably damage. Some well-built structures are slightly damaged. Some cracks may appear on dikes, fish ponds, road surface, or concrete hollow block walls. Limited liquefaction, lateral spreading and landslides are observed. Trees are shaken strongly. (Liquefaction is a process by which loose saturated sand lose strength during an earthquake and behave like liquid).

VIII-Very Destructive - People panicky. People find it difficult to stand even outdoors. Many well-built buildings are considerably damaged. Concrete dikes and foundation of bridges are destroyed by ground settling or toppling. Railway tracks are bent or broken. Tombstones may be displaced, twisted or overturned. Utility posts, towers and monuments mat tilt or topple. Water and sewer pipes may be bent, twisted or broken. Liquefaction and lateral spreading cause man- made structure to sink, tilt or topple. Numerous landslides and rockfalls occur in mountainous and hilly areas. Boulders are thrown out from their positions particularly near the epicenter. Fissures and faults rapture may be observed. Trees are violently shaken. Water splash or stop over dikes or banks of rivers.

IX-Devastating - People are forcibly thrown to ground. Many cries and shake with fear. Most buildings are totally damaged. bridges and elevated concrete structures are toppled or destroyed. Numerous utility posts, towers and monument are tilted, toppled or broken. Water sewer pipes are bent, twisted or broken. Landslides and liquefaction with lateral spreadings and sandboils are widespread. the ground is distorted into undulations. Trees are shaken very violently with some toppled or broken. Boulders are commonly thrown out. River water splashes violently on slops over dikes and banks.

X-Completely Devastating - Practically all man-made structures are destroyed. Massive landslides and liquefaction, large scale subsidence and uplifting of land forms and many ground fissures are observed. Changes in river courses and destructive seiches in large lakes occur. Many trees are toppled, broken and uprooted.

RUA OF A STUDENT'S LEARNING

Week 5 ANSWER SHEET *(Please submit only the answers. Do not return the entire module.)*

Name: _____ **Section:** _____
LAST NAME, FIRST NAME MIDDLE INITIAL

Enabling Assessment Activity No.3. Earthquake Hazards

Identify the effects of the following earthquake hazards to society and community (20 pts)

Hazard	Effects
Ground Shaking	
Ground Rupture	
Tsunami	
Liquefaction	
Landslide	

ASSIMILATION

Using short essay, poetry, slogan or poster, indicate if it is possible to predict an upcoming earthquake? (10 pts)

RUA OF A STUDENT'S LEARNING

Week 6 ANSWER SHEET *(Please submit only the answers. Do not return the entire module.)*

Name: _____Section: _____
LAST NAME, FIRST NAME MIDDLE INITIAL

Performance Check No.3. EARTHQUAKE HAZARD MAPPING

1. Get a copy of your barangay map from the barangay hall
   Identify and mark the following on the map:
   I. Barangay Hall
   II. Village Clubhouse
   III. Schools, Day Care Center
   IV. Hospitals, Clinics,
   V. Groceries, Markets
   VI. Important infrastructures (bridges, gymnasium/ open or covered courts, etc)
   VII. Water tanks; deep wells
2. Supposing a 5.5 magnitude earthquake hits your barangay with the epicenter located at the Barangay Hall, assess the potential hazard that would occur on the following places listed above in your barangay

HAZARD	AREAS AFFECTED			Remarks
GROUND SHAKING	High	Moderate	Low	
EARTHQUAKE INDUCED LANDSLIDE	High	Moderate	Low	
TSUNAMI	High	Moderate	Low	

PRE-REQUISITE ASSESSMENT
Why is the Philippines prone to strong earthquakes and volcanic eruption?

Week 7-8: Volcanic Hazards

***LEARNING MATERIALS*:** Module, pen, paper, old earth science books, internet (if applicable)
PRE-REQUISITE CONTENT KNOWLEDGE: Earthquakes
PRE-REQUISITE SKILL: Basic knowledge on identifying effect of a particular ahazard

TIME ALLOTMENT: 8 HRS
CONSULTATION: For inquiries and clarifications regarding the lesson, you may contact your teacher thru his FB Messenger or thru email

RUA: *At the end of the lesson, you should be able to:*
Explain various volcano-related hazards
Recognize signs of an impending volcanic eruption
Interpret different volcano hazard maps

INSTITUTIONAL VALUES*: Technological Literacy, Environmental Awareness, Social Responsibility*
Students will be able to apply
a. Technological literacy on identifying signs of an impending volcanic eruption
b. Environmental awareness on the various potential hazards of volcanic eruption
c. Social Responsibility on recognizing the effects of volcanic eruption

OVERVIEW OF THE LESSON
This lesson is all about volcanic eruption, the dangers and effects of volcanic hazards, as well as signs of an impending volcanic eruption and basic knowledge on interpreting a hazard map

STUDENT'S EXPERIENTIAL LEARNING

Review points on Volcano

Volcanoes are openings, or vents where lava, tephra (small rocks), and steam erupt on to the Earth's surface. Many mountains form by folding, faulting, uplift, and erosion of the Earth's crust. Volcanic terrain, however, is built by the slow accumulation of erupted lava. The vent may be visible as a small bowl shaped depression at the summit of a cone or shield-shaped mountain. Through a series of cracks within and beneath the volcano, the vent connects to one or more linked storage areas of molten or partially molten rock (magma). This connection to fresh magma allows the volcano to erupt over and over again in the same location. In this way, the volcano grows ever larger, until it is no longer stable. Pieces of the volcano collapse as rock falls or as landslides

The Philippines is an archipelago of more than 7100 islands. Most of these islands are of volcanic origin. The Philippines lies between the Pacific and Eurasian Plates which makes it highly vulnerable to typhoons, floods, landslides, volcanic eruptions and earthquakes. The Pacific Ring of Fire that runs at the western rim of the Pacific Ocean is the most seismically active part of the earth, typified by a belt of active volcanoes and earthquake generators. Around 20 earthquakes are registered daily, though most are too weak to be felt. There are about 300 volcanoes in the Philippines. Twenty-two (22) of these are active while the larger percentage remains dormant as of the record. The majority of the active volcanoes are located in the island of Luzon. The six most active volcanoes are Mayon, Hibok-Hibok, Pinatubo, Taal, Kanlaon and Bulusan.

VOLCANIC PHENOMENA	NEGATIVE IMPACTS / WHY IT IS HAZARDOUS
Lava Flows are stream-like flows of incandescent molten rock erupted from a crater or fissure. When lava is degassed and/or very viscous, it tends to extrude extremely slowly, forming lava domes.	Lavas can burn. Lavas can bury. Can trigger dangerous pyroclastic flows.
Ashfall or tephra fall are showers of airborne fine- to coarse-grained volcanic particles that fallout from the plumes of a volcanic eruption; ashfall distribution/ dispersal is dependent on prevailing wind direction	*Can cause poor or low visibility* Burial by ashfall Producing suspensions of fine-grained particles in air and water
Pyroclastic flows and surges (Pyroclastic density current) are turbulent mass of ejected fragmented volcanic materials (ash and rocks), mixed with hot gases (200 degrees C to 700 degrees C to as hot as 900 degrees C) that flow downslope at very high speeds (>60kph). Surges are the more dilute, more mobile derivatives or pyroclastic flows.	Destroy anything on its path by direct impact Burn sites with hot rocks debris Burn forests, farmlands, destroy crops and Buildings Deadly effects include asphyxiation (inhalation of hot ash and gases), burial, incineration (burns) and crushing from impacts.
Lahars are rapidly flowing thick mixture of volcanic sediments (from the pyroclastic materials) and water, usually triggered by intense rainfall during typhoons, monsoons and thunderstorms. Lahar can occur immediately after an eruption or can become long-term problem if there is voluminous pyroclastic materials erupted such as the case of 1991 Pinatubo eruption. Lahars can also occur long after an eruption has taken place such as the lahars at Mayon Volcano after the 1984 eruption	Lahars can destroy by direct impact (bridges, roads, houses) Lahars can block tributary stream and form a lake. Lahars can bury valleys and communities with debris. Lahars can lead to increased deposition of sediments along affected rivers and result to long-term flooding problems in the low-lying downstream communities.
Volcanic gases- gases and aerosols released into the atmosphere, which include water vapor, hydrogen sulfide, sulfur dioxide, carbon monoxide, hydrogen chloride, hydrogen fluoride	Sulfur dioxide (SO2), carbon dioxide (CO2), and hydrogen fluoride (HF) are some volcanic gases that pose hazard to people, animals, agriculture and property. SO2 can lead to acid rain. High concentrations of CO2 which is colorless and odorless can be lethal to people, animals and vegetation. Fluorine compounds can deform and kill animals that grazed on vegetation covered with volcanic ash
Debris avalanche or volcanic landslide - massive collapse of a volcano, usually triggered by an earthquake or volcanic eruption. An example of recent debris avalanche event occurred during the 1980 eruption of Mt. St Helens. Based on present morphology of volcanoes, Iriga Volcano in Camarines Sur, Banahaw Volcano and Quezon Province and Kanlaon Volcano had pre-historic debris avalanche events.	When a huge portion of the side of a volcano collapses due to slope failure. This results to massive destruction similar to what happened in Mt. St. Helens in the USA in 1980. The huge volcanic debris avalanche typically leaves an amphitheater-like feature and at the base of volcanoes with debris avalanche event, a hummocky topography (small hills all over).
Ballistic projectiles - are Volcanic materials directly ejected from the volcano's vent with force and trajectory	Ballistic projectiles endanger life and property by the force of impact of falling fragments, but this occurs only close to an eruption vent.

Tsunami- sea waves or wave trains that are generated by sudden displacement of water (could be generated during undersea eruptions or debris avalanches)	An eruption that occurs near a body of water may generate tsunamis if the pyroclastic materials enter the body of water and cause it to be disturbed and displaced, forming huge waves.

Precursors of an Impending Volcanic Eruption

The following are commonly observed signs that a volcano is about to erupt. These precursors may vary from volcano to volcano.

1. Increase in the frequency of volcanic quakes with rumbling sounds; occurrence of volcanic tremors
2. Increased steaming activity; change in color of steam emission from white to gray due to entrained ash
3. Crater glow due to presence of magma at or near the crater
4. Ground swells (or inflation), ground tilt and ground fissuring due to magma intrusion
5. Localized landslides, rockfalls and landslides from the summit area not attributable to heavy rains
6. Noticeable increase in the extent of drying up of vegetation around the volcano's upper slopes
7. Increase in the temperature of hot springs, wells (e.g. Bulusan and Canlaon) and crater lake (e.g. Taal) near the volcano
8. Noticeable variation in the chemical content of springs, crater lakes within the vicinity of the volcano
9. Drying up of springs/wells around the volcano
10. Development of new thermal areas and/or reactivation of old ones; appearance of sulfaterras.

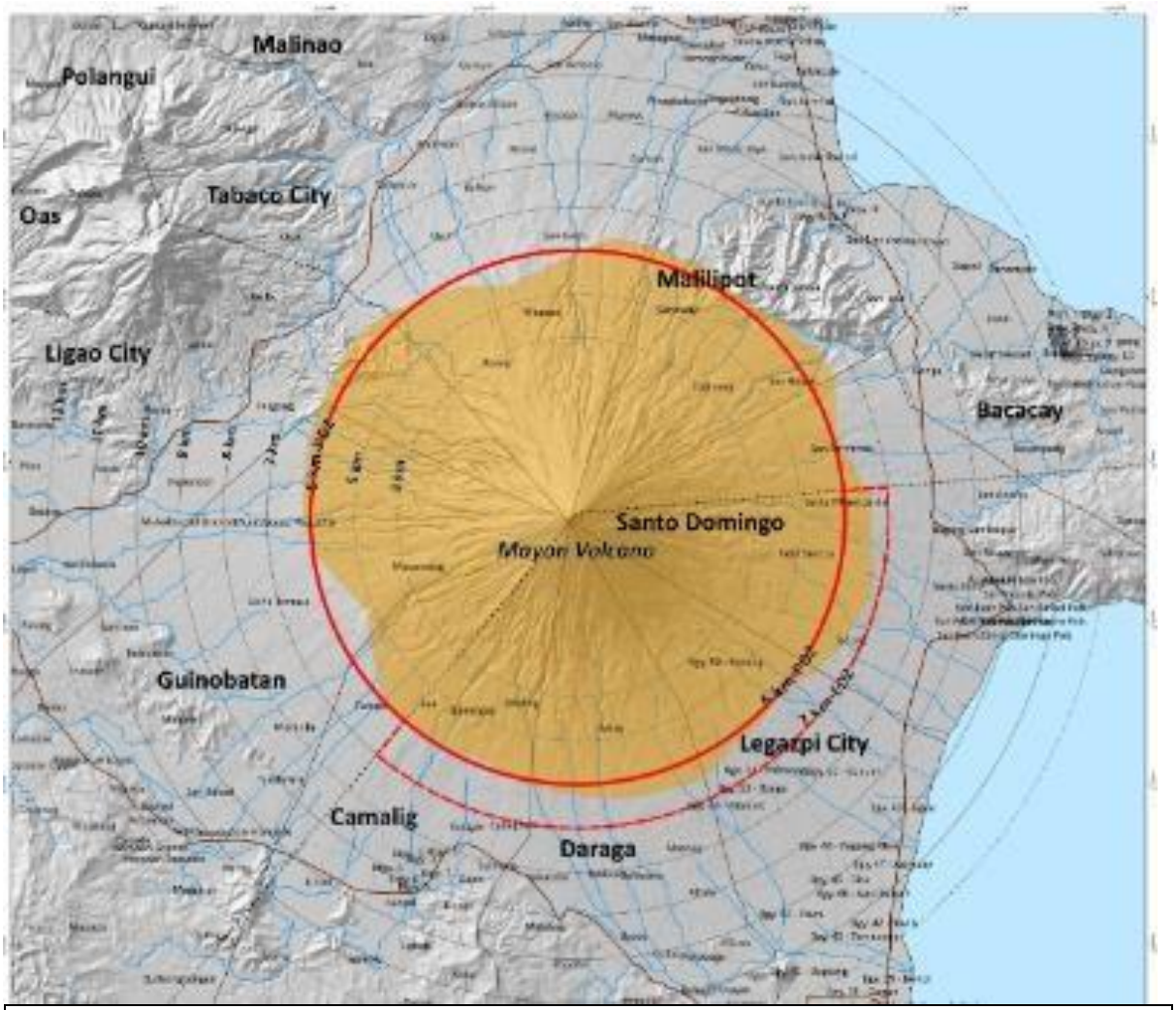
RUA OF A STUDENT'S LEARNING

Week 7 ANSWER SHEET *(Please submit only the answers. Do not return the entire module.)*

Name: _____ **Section:** _____
LAST NAME, FIRST NAME MIDDLE INITIAL

Enabling Assessment Activity No.4. Volcanic Hazard Mapping

1. Attributing impacts to specific hazards were already discussed.
2. Study the hazard map of Mayon Volcano provided
3. Enumerate the areas that are under the danger zone (7 km, 10km, 15 km and 17 km).
4. Identify the status of the said volcano if it is generally safe for the residents living along the danger zone of the volcano.



AREAS UNDER THE DANGER ZONE			
7 km	10 km	15 km	17 km

Analysis:

RUA OF A STUDENT'S LEARNING

Week 8 ANSWER SHEET *(Please submit only the answers. Do not return the entire module.)*

Name: _____Section: _____
LAST NAME, FIRST NAME MIDDLE INITIAL

Performance Check No. 4 - Emergency Preparedness Plan

Develop a family emergency preparedness plan to guide them on what to do before, during, and after a volcanic eruption.

BEFORE	DURING	AFTER