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DepED
DEPARTMENT OF EDUCATION

Lesson Exemplar for Science

Quarter 4
Lesson
3

Lesson Exemplar for Science Grade 7
Quarter 4: Lesson 3 (Week 3)
SY 2024-2025

Development Team

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SCIENCE (EARTH AND SPACE SCIENCE) /QUARTER 4/ GRADE 7

I. CURRICULUM CONTENT, STANDARDS, AND LESSON COMPETENCIES	
A. Content Standards	The learners learn that the damage or effects on communities depend on the magnitude of and distance from an earthquake.
B. Performance Standards	By the end of the Quarter, learners will appreciate the value of using systems to analyze and explain natural phenomena and demonstrate their understanding of the dynamics of faults and earthquakes. They are confident in identifying and assessing the earthquake risk for their local communities using authentic and reliable secondary data. They use the country's disaster awareness and risk reduction management plans to identify and explain to others what to do in the event of an earthquake. Learners explain the cause and effects of secondary impacts that some coastal communities may experience should a tsunami be produced by either local or distant earthquake activity. Learners use reliable scientific information to identify and explain how solar energy influences the atmosphere and weather systems of the Earth and use such information to appreciate and explain the dominant processes that influence the climate of the Philippines.
C. Learning Competencies and Objectives	***Learning Competencies: Explain how earthquakes result in tsunamis that devastate shoreline communities*** **Learning Objectives:** 1. Identify the different types of seismic waves; 2. Explain how earthquakes result in tsunamis; and 3. Realize how tsunamis devastate shoreline communities.
C. Content	Topic: Earthquake Scenarios and Tsunami Sub Topics: **1.** Types of Seismic Waves **2.** Occurrence of Tsunami
D. Integration	Safety and Resiliency; Impacts on society as well as the economic growth/ Society and Economic Impacts

II. LEARNING RESOURCES
• Tsunami | Run-up and Inundation, tidal wave, sea level & inundation. (n.d.). https://www.sms-tsunami-warning.com/pages/runup-inundation

- Libretexts. (2022, May 6). 8.3: Seismic waves. Geosciences LibreTexts. https://geo.libretexts.org/Bookshelves/Geology/Fundamentals_of_Geology_(Schulte)/08%3A_Earthquakes/8.03%3A_Seismic_Waves
- Bhuyan, S. (2020, April 11). Seismic Waves: Definition, Types, Examples, and diagram. Science Facts. https://www.sciencefacts.net/seismic-waves.html
- Tsunamis. (n.d.). Environment. https://www.nationalgeographic.com/environment/article/tsunamis

III. TEACHING AND LEARNING PROCEDURE		NOTES TO TEACHERS
A. Activating Prior Knowledge	• **Short Review (Day 1)** ***It's a Picture Puzzle!*** The learners will complete the puzzle and answer the questions that follow to review the past lesson.  *Image retrieved at: https://cdnph.upi.com/svc/sv/upi/com/9441556007245/2019/1/a6dc84a722520eec3b235c1a3320f90c/Philippines-rocked-by-second-earthquake-in-two-days.jpg*	• Target time frames may change depending on the ability of the learners and the flow of discussion. • The teacher will prepare the puzzle ahead of time and cut it. This activity may be performed by group and let them compete. The fastest to complete the puzzle will get an extra point. • Earthquakes are caused by the sudden release of energy stored in the Earth's crust. When tectonic plates shift or collide, seismic waves are generated, spreading outward from the point of origin, called the epicenter. • The higher the magnitude of an earthquake, the greater the potential for widespread damage and devastation in the affected community.

	Processing Questions: 1. What causes earthquakes? 2. How does the magnitude of the earthquake affect the damage that it causes in the community? 3. What happens if the earthquake is generated underwater?	• In some cases, these earthquakes occur underwater, along subduction zones, where one tectonic plate is forced beneath another. This movement can displace large volumes of water, resulting in the formation of a tsunami.
B. Establishing Lesson Purpose	• **Lesson Purpose** The teacher will play a short video clip to understand how tsunamis are generated and how they affect the shoreline community.  Video link: https://www.youtube.com/watch?v=oWzdgBNfhQU After watching the video clip, ask the learners the following questions: • What is your reaction about the video? • Based on the video, how are tsunamis generated? • What are the possible damages brought by a tsunami?	Show a short video clip or images depicting the devastation caused by a recent tsunami. Engage students in a brief discussion about their reactions to what they saw and what questions they have about how tsunamis occur. If television is not available, you may just ask questions to learners relating to what they already know about tsunamis and the possible damage they may cause to the community near the shoreline.

- **Unlocking Content Vocabulary**
  Decode the mystery word. The learners will decode the mystery word by altering the numerical value with the vowels assigned to them.

1	2	3	4	5
A	E	I	O	U

1)

T	S	5	N	A	M	3

2)

B	4	D	Y

W	1	V	2	S

3)

S	5	R	F	1	C	2

W	1	V	2	S

4)

R	5	N	-	5	P

5)

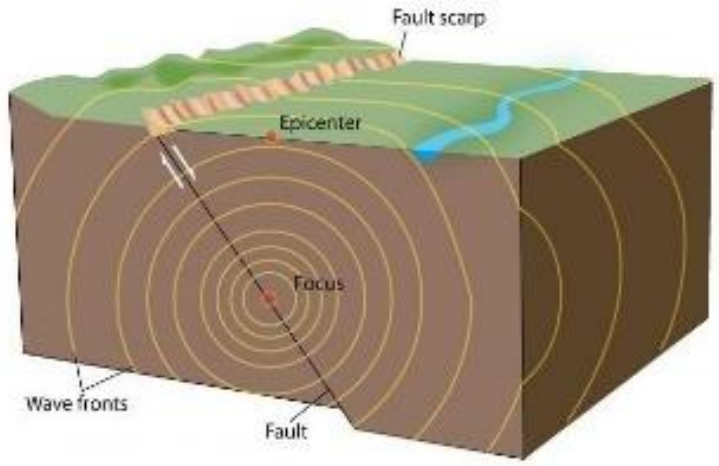
3	N	5	N	D	1	T	3	4	N

Explain that learners need to alter the numbers with correct letters by looking at the reference value.

Provide definitions and examples for each term, encouraging students to ask questions and clarify any misunderstandings.

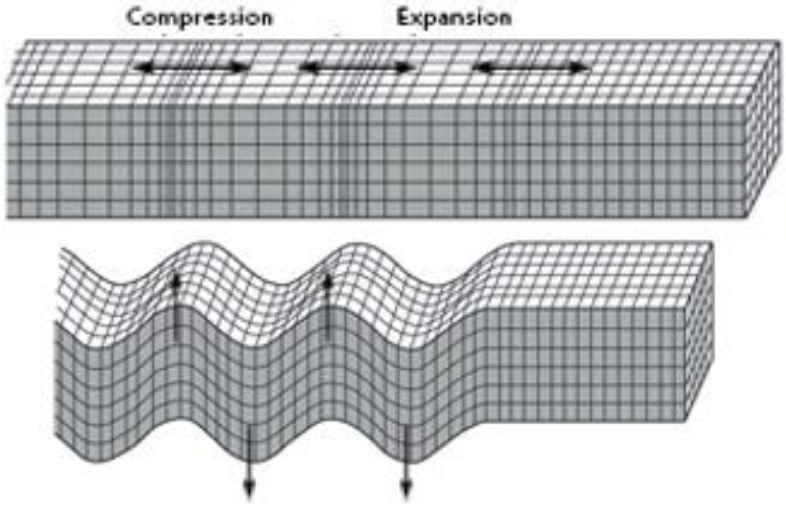
Answers:
1) TSUNAMI. is a series of ocean waves that sends surges of water, sometimes reaching heights of over 100 feet (30.5 meters), onto land. These walls of water can cause widespread destruction when they crash ashore.
2) BODY WAVES. These are body waves, which move into the Earth's core at a greater frequency than surface waves.

		Body waves are classified as primary (P) or secondary (S) waves. 3) SURFACE WAVES. Surface waves are similar to transverse waves, except they flow over the Earth's surface-air boundary, or through the crust. 4) RUN-UP. Refers to the large amount of water that a tsunami pushes onto the shore above the regular sea level. 5) INUNDATION. is the result of a tsunami traveling a long distance inland and is a horizontal measurement of the path of the tsunami. Flooding can occur for up to 300 meters or more covering the area with debris.
C. Developing and Deepening Understanding	**(Day 2)** **SUB-TOPIC 1: Types of Seismic Waves** **1. Explicitation** Ask a learner to recall what they learned from the previous lesson on the anatomy of an earthquake and how it is generated.	Let the learners recall what they learned about the anatomy of an earthquake. This diagram will lead them to the idea that seismic waves radiate from the focus of an earthquake. If the learners cannot present the idea on their



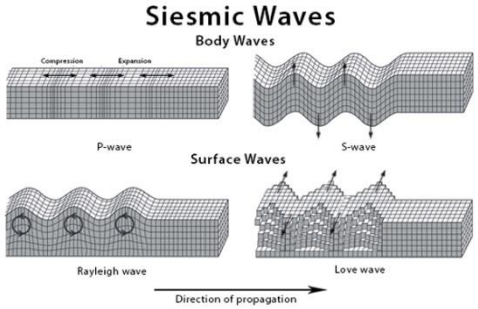
2. Worked Example

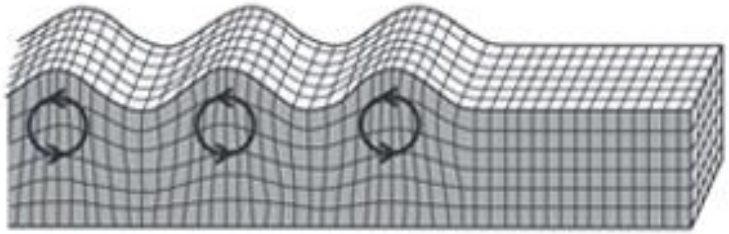
Learners will try to match the description with the correct figure.

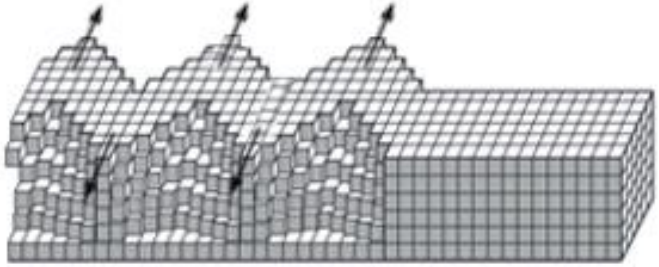


own, you may remove the label and ask them leading questions such as:

1) Where can you find the:
   a. focus?
   b. epicenter?
2) Where did the waves originated?
3) How earthquakes occur?







The motion of Love wave particles forms a horizontal line that is perpendicular to the propagation direction. The energy of Love waves radiates in two directions rather than three.

P waves are compressional waves that travel through solids, liquids, and gases. They propagate through a substance by compressing and expanding it alternately.

The motion of Rayleigh wave is a mix of longitudinal, compressional, and dilatation. As a result, the particles travel elliptically in the vertical plane.

S-waves (Secondary waves): They are also known as shear waves, and they can only propagate in hard, solid materials by vibrating particles in a direction perpendicular to the propagation.

	3. Lesson Activity **I. Activity No. 3.1:** Seismic Wave Simulation **II. Objective(s):** At the end of the activity, you should be able to classify the different types of seismic waves through a hands-on simulation. **III. Materials Needed:** Slinky, and large flat surface (such as a table or floor) **IV. Instructions:** Read the description of each type of seismic wave. **Types of Seismic Waves** a) Body Waves - travel through the interior of the Earth and have a frequency higher than the surface wave. • P-waves (Primary waves): also known as pressure waves, may travel through both solid and liquid materials. They move quickly and are the first to reach the seismograph. They propagate through a substance by compressing and expanding it alternately. The particles' velocity is parallel to the direction of wave transmission. • S-waves (Secondary waves): They are also known as shear waves, and they can only propagate in hard, solid materials by vibrating particles in a direction perpendicular to the propagation. As a result, they cannot spread across a liquid. Seismologists could verify the existence of a liquid outer core of the Earth by investigating the paths of S waves. b) Surface Waves – are waves that flow along the Earth's surface-air boundary, or into the crust. They have lower frequency than body waves. They are easily identified and are responsible for earthquake-related damage and devastation. Surface waves have particles that move in a circular or elliptical pattern. The strength of surface waves decreases as they go deeper below the surface.	If slinky is not available, you may use a rope.

	• Rayleigh waves - are named after the British scientist Lord Rayleigh, who predicted their existence. Their motion is a mix of longitudinal, compressional, and dilatation. As a result, the particles travel elliptically in the vertical plane. These waves are dispersive, and their amplitudes often decline exponentially with depth in the earth. • Love Waves - named after British mathematician A. E. H. Love, according to him, the particles of Love waves jerk back and forth perpendicular to the direction of wave transmission, much like S-waves. The motion of Love wave particles forms a horizontal line that is perpendicular to the propagation direction. The energy of Love waves radiates in two directions rather than three. The amplitude often diminishes significantly with depth. Love waves move quicker than Rayleigh waves. **Simulation** 1. Place the slinky on a flat surface with enough space. Observe and describe the motion of the slinky for each wave type. 2. Use the slinky to simulate how each waves move. *Set-up A*. Hold one end of the slinky and shake it side to side horizontally. *Set-up B*. Hold one end of the slinky and quickly push and pull it back and forth horizontally. *Set-up C*. Push the slinky horizontally along its length, causing it to compress and stretch sideways. *Set-up D*. Hold one end of the slinky firmly in place. Using your other hand, move the end of the slinky up and down vertically while also moving it side to side horizontally in a circular motion. Guide Questions: 1. Which type of seismic waves is represented by: *Set-up A?* _____ *Set-up B?* _____ *Set-up C?* _____ *Set-up D?* _____	Answer: Set-up A: S-wave Set-up B: P-wave Set-up C: Love wave Set-up D: Rayleigh wave 2. Seismic waves can have significant and wide-ranging

	2. How do the waves might impact structures and communities during an earthquake? _____ _____ _____ _____ 3. Which among the types of waves can cause the most damage and why? _____ _____ _____ _____	impacts on structures and communities during an earthquake, including structural damage, infrastructure failure, loss of life and injury, and psychological and social consequences. 3. Surface waves are the most damaging during an earthquake due to their concentrated energy, large amplitudes, frequency content, effect on buildings, and long duration of shaking. Understanding the characteristics and behavior of surface waves is essential for assessing seismic hazards, designing resilient structures, and implementing effective mitigation measures to reduce the risk of damage and loss during earthquakes.

Rubric or Score Guide

Advanced (5 points)	Proficient (4)	Nearly Proficient (3)	Emerging (2)	Needs Improvement (1)
All of the required fields were answered, and the answers to guide questions were well-organized and completely explained in detail.	All of the required fields were answered, and the answers were well-organized and completely explained, but not in detail.	Some of the required fields were answered, and the answers were somewhat organized and explained but not in detail.	Some of the required fields were answered, but the answers were not organized and not explained in detail.	Few of the required fields were answered, and the answers were not organized and not explained in detail.

The teacher may modify the rubric.

SUB-TOPIC 2: Occurrence of Tsunami (Day 3)

1. **Explicitation**

   Demonstration. Demonstrate how water reacts with vibrations.
   Materials needed: A shallow tray or dish (clear, if possible), water, speaker with a strong bass output, music player or device to play low-frequency sounds, and a rag.

   - Fill the shallow tray or dish with water until it's about half full.
   - Place the tray on top of the speaker.
   - Connect the speaker to a music player or device.
   - Choose a song or sound clip with a strong and steady bass line. Make sure it's something that produces low-frequency vibrations.
   - Play the selected sound through the speaker at a moderate volume.
   - Observe the surface of the water in the tray as the sound plays.

   Ask the learners about what they have observed.
   What did the speaker produced that made the water move?
   What will happen if there are bigger vibrations produced?
   Thinking big: Is it possible for bodies of water to be moved by vibrations?

The teacher prepares the materials needed for the demonstration.

Lead the learners to form the concept of water movement due to vibrations.

	2. Worked Examples **I. Activity No. 3.2:** Tsunami Simulation Model **II. Objective(s):** At the end of the activity, you should be able to understand how tsunamis can devastate shoreline communities and the factors that contribute to their destructive power. **III. Materials Needed:** Large shallow container, sand or soil, small toy buildings, trees, and people (optional), water, plastic spoon, rag **IV. Instructions:** **1.** Prepare the simulation area by filling half of the shallow container with sand or soil tilted to one end to represent the shoreline. **2.** Optionally, set up small toy buildings, trees, and people on the sand to represent a coastal community. **3.** Pour a layer of water into the other end of the container to represent the ocean. **4.** Predict what might happen when a tsunami strikes the coastline. **5.** Using the plastic spoon or stick, create waves in the water to simulate the arrival of the tsunami. Make sure to demonstrate how the waves approach the shoreline and increase in height as they come closer. Observe what happens to your set-up. **Guide Questions:** 1. What happened to the buildings and infrastructure when the tsunami struck? 2. How did the waves affect the shoreline and the area inland? 3. What challenges might the community face in the aftermath of the tsunami? 4. What measures could be taken to mitigate the impact of tsunamis on shoreline communities?	• If large shallow container is not available, learners may bring a baking dish or a plastic storage container. • If Lego is available, they may create buildings out of it, if not they may use any small toy available at home. • In preparing the simulation, explain to students that they will be simulating a tsunami and its impact on a shoreline community. **Possible answers:** 1. When the tsunami struck, the buildings and infrastructure in the simulated community were likely damaged or destroyed. • Emphasize that in real-world scenarios, the force of the waves can cause buildings to collapse, while the flooding can damage roads, bridges, and other infrastructure. In

Rubric or Score Guide

Advanced (5 points)	Proficient (4)	Nearly Proficient (3)	Emerging (2)	Needs Improvement (1)
Conducted a proper simulation, and the answers to guide questions were well-organized and completely explained in detail.	Conducted a proper simulation, and the answers were well-organized and completely explained, but not in detail.	Conducted simulation with minimal error, and the answers were somewhat organized and explained but not in detail.	Conducted simulation with errors, but the answers were not organized and not explained in detail.	Was not able to conduct a simulation, and the answers were not organized and not explained in detail.

some cases, buildings may be swept away entirely by the force of the water.

2. The waves affected the shoreline by causing flooding and erosion.

- Note that as the tsunami waves crashed onto the shore, they inundated low-lying areas, damaging coastal structures and vegetation. Inland, the force of the waves can carry debris and sediment, causing further flooding and damage to areas farther from the coastline.

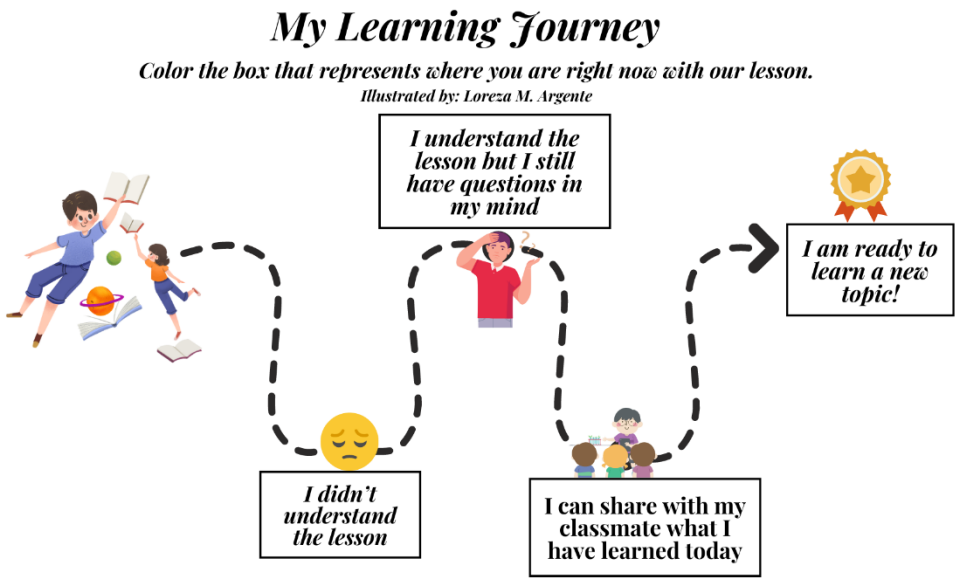
3. The community might face numerous challenges in the aftermath of the tsunami, including:

- Loss of life and injuries among residents.
- Destruction of homes, buildings, and infrastructure.
- Displacement of residents who are left homeless.
- Difficulty accessing clean water, food, and medical supplies.
- Disruption of essential services such as electricity, communication, and transportation.

		• Environmental damage and contamination of land and water sources. • Economic hardship due to loss of livelihoods and businesses. 4. Possible answers: • Implement early warning systems to alert residents of an impending tsunami, allowing for timely evacuation. • Establish and enforce building codes and land-use regulations to ensure that new construction is located away from high-risk areas and designed to withstand tsunami impacts. • Develop and maintain natural barriers such as mangroves, sand dunes, and coastal forests to absorb the energy of tsunami waves and reduce their impact on coastal communities. • Educate residents about tsunami preparedness and evacuation procedures, including the location of safe evacuation routes and assembly points. • Invest in infrastructure improvements, such as seawalls, levees, and tsunami-resistant buildings, to protect

		shoreline communities from the destructive force of tsunamis. • Conduct regular drills and exercises to test emergency response plans and ensure that residents and emergency responders are prepared to effectively respond to a tsunami event.
	3. Lesson Activity Learners can choose among the performances below focusing on the impacts of tsunamis in the shoreline communities: 1. Song/jingle 2. Poem/spoken poetry 3. Poster-making 4. Role-play 5. Brochure **Rubric in Rating the Performance:** Relevance to the Topic: 5 points Originality of the content: 5 points Creativity and impact: 5 points Time-bound: 5 points Total: 20 points	Learners may perform the activity in group or individual. The rubric may be modified by the teacher.
D. Making Generalizations	• **Learners' Takeaways (Day 4)** 1. Compare and Contrast the body waves and the surface waves. 2. Explain how earthquakes result in the formation of tsunamis 3. Describe the specific ways in which tsunamis devastate shoreline communities, including the impact on infrastructure, human lives, and the environment.	**Possible answers:** 1. Both body waves and surface waves are seismic waves that propagate through the Earth, but they differ in their location of propagation, motion, speed, and

		nature of displacement. Body waves travel through the Earth's interior and include P-waves and S-waves, while surface waves travel along the Earth's surface and have a rolling motion that affects the ground surface. 2. Earthquakes can generate tsunamis through several geological processes, primarily in subduction zones where tectonic plates converge. When an earthquake occurs underwater, it can cause vertical displacement of the ocean floor, displacing a large volume of water and generating a series of waves known as a tsunami. This displacement creates seismic waves that travel through the ocean, carrying energy and momentum that propagate outward from the earthquake epicenter. As the seismic waves reach shallow coastal areas, they can increase in height and form a tsunami that travels across the ocean with devastating force. 3. Tsunamis devastate shoreline communities by causing widespread flooding, destruction of buildings and infrastructure, loss of life, and environmental damage. The force of the tsunami waves can demolish homes, sweep away vehicles, and

	• **Reflection on Learning**  Question/s I wanted to ask: _____ _____ _____	inundate coastal areas with debris and sediment. The flooding caused by tsunamis can contaminate freshwater sources, damage crops, and disrupt ecosystems. In addition to the immediate impact on human lives and infrastructure, tsunamis can also have long-term economic, social, and environmental consequences for affected communities. The teacher may reproduce the learning journey map. If reproduction is not possible, the learners may just write the statement that corresponds to their answer.

IV. EVALUATING LEARNING: FORMATIVE ASSESSMENT AND TEACHER'S REFLECTION		NOTES TO TEACHERS
A. Evaluating Learning	**1. Assessment** 1. Which of the following statements best describes the motion of Love waves during an earthquake? A. Love waves travel in a rolling motion parallel to the direction of wave propagation. B. Love waves travel in a rolling motion perpendicular to the direction of wave propagation. C. Love waves travel in a compressional motion perpendicular to the direction of wave propagation. D. Love waves travel in a compressional motion parallel to the direction of wave propagation. 2. How do earthquakes occurring underwater or along subduction zones contribute to the formation of tsunamis? A. Underwater earthquakes release energy that generates seismic waves, which propagate through the water and create tsunami waves. B. Subduction zone earthquakes cause the sudden uplift of the seafloor, displacing water and generating tsunami waves. C. Underwater earthquakes trigger volcanic eruptions, leading to the formation of tsunamis. D. Subduction zone earthquakes cause the release of toxic gases, resulting in the formation of tsunamis. 3. What is the primary factor that determines the extent of devastation caused by tsunamis on shoreline communities? A. The magnitude of the earthquake that triggered the tsunami. B. The frequency of tsunami events in the region. C. The proximity of the shoreline community to the earthquake epicenter. D. The presence of advanced warning systems in the affected area.	**Answers:** 1. B. Love waves travel in a rolling motion perpendicular to the direction of wave propagation. 2. A. Underwater earthquakes release energy that generates seismic waves, which propagate through the water and create tsunami waves. 3. A. The magnitude of the earthquake that triggered the tsunami. 4. C. Surface waves interact with the seafloor, creating additional energy and increasing the height of tsunami waves. 5. A. By constructing seawalls and levees to absorb the energy of tsunami waves.

	4. In what way do surface waves contribute to the destructive power of tsunamis? A. Surface waves propagate quickly through the water, causing widespread flooding. B. Surface waves generate strong winds that intensify the impact of tsunamis on shoreline communities. C. Surface waves interact with the seafloor, creating additional energy and increasing the height of tsunami waves. D. Surface waves carry debris and sediment, exacerbating the damage caused by the initial wave impact. 5. How can coastal communities mitigate the impact of tsunamis on their shoreline infrastructure? A. By constructing seawalls and levees to absorb the energy of tsunami waves. B. By encouraging residents to build homes closer to the coastline for easier evacuation during tsunamis. C. By relying solely on early warning systems to evacuate residents before the arrival of a tsunami. D. By conducting regular drills and exercises to test emergency response plans.			
1. Teacher's Remarks	*Note observations on any of the following areas:*	**Effective Practices**	**Problems Encountered**	
	strategies explored			
	materials used			
	learner engagement/ interaction			
	others			

2. Teacher's Reflection	*Reflection guide or prompt can be on:* ▪ *principles behind the teaching* *What principles and beliefs informed my lesson?* *Why did I teach the lesson the way I did?* ▪ *students* *What roles did my students play in my lesson?* *What did my students learn? How did they learn?* ▪ *ways forward* *What could I have done differently?* *What can I explore in the next lesson?*	