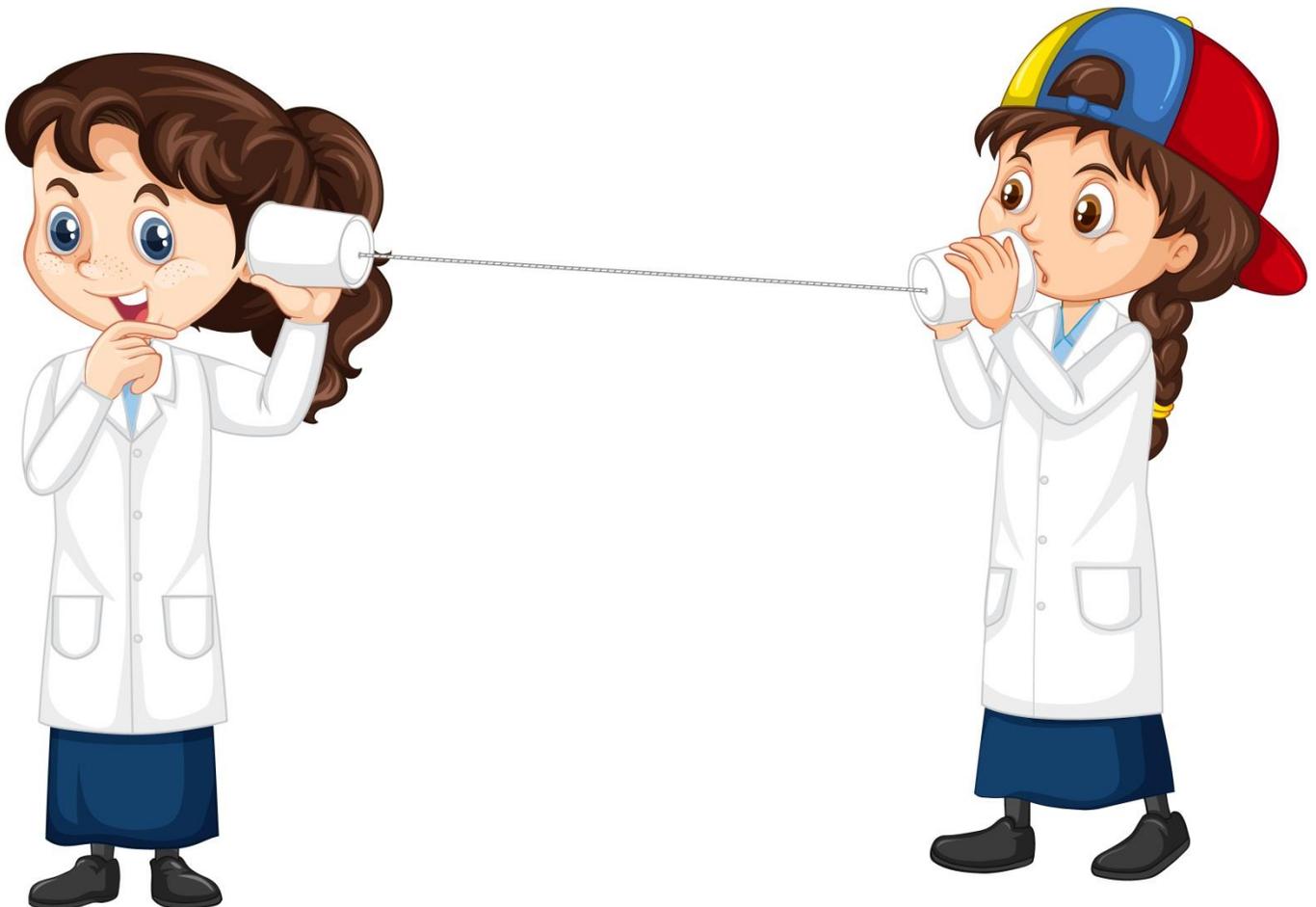


LEARNING MODULE

Science | G7 | Q3

Waves and Sound



NOTICE TO THE SCHOOLS

This learning module (LM) was developed by the Private Education Assistance Committee under the GASTPE Program of the Department of Education. The learning modules were written by the PEAC Junior High School (JHS) Trainers and were used as exemplars either as a sample for presentation or for workshop purposes in the JHS In-Service Training (INSET) program for teachers in private schools.

The LM is designed for online learning and can also be used for blended learning and remote learning modalities. The year indicated on the cover of this LM refers to the year when the LM was used as an exemplar in the JHS INSET and the year it was written or revised. For instance, 2017 means the LM was written in SY 2016-2017 and was used in the 2017 Summer JHS INSET. The quarter indicated on the cover refers to the quarter of the current curriculum guide at the time the LM was written. The most recently revised LMs were in 2018 and 2019.

The LM is also designed such that it encourages independent and self-regulated learning among the students and develops their 21st century skills. It is written in such a way that the teacher is communicating directly to the learner. Participants in the JHS INSET are trained how to unpack the standards and competencies from the K-12 curriculum guides to identify desired results and design standards-based assessment and instruction. Hence, the teachers are trained how to write their own standards-based learning plan.

The parts or stages of this LM include Explore, Firm Up, Deepen and Transfer. It is possible that some links or online resources in some parts of this LM may no longer be available, thus, teachers are urged to provide alternative learning resources or reading materials they deem fit for their students which are aligned with the standards and competencies. Teachers are encouraged to write their own standards-based learning plan or learning module with respect to attainment of their school's vision and mission.

The learning modules developed by PEAC are aligned with the K to 12 Basic Education Curriculum of the Department of Education. Public school teachers may also download and use the learning modules.

Schools, teachers and students may reproduce the LM so long as such reproduction is limited to (i) non-commercial, non-profit educational purposes; and to (ii) personal use or a limited audience under the doctrine of fair use (Section 185, IP Code). They may also share copies of the LM and customize the learning activities as they see fit so long as these are done for non-commercial, non-profit educational purposes and limited to personal use or to a limited audience and fall within the limits of fair use. This document is password-protected to prevent unauthorized processing such as copying and pasting.

Lesson 2: Waves and Sound

INTRODUCTION AND FOCUS QUESTION(S):

Have you ever wondered why tsunamis occur? Or why you hear echoes once you shout something inside a cave? Tsunamis and echoes are just few of the examples of a natural phenomenon we call waves. We experience different types of waves in our daily encounters and you will be surprised to know that waves have widespread applications in our daily life. For example, the light we see is a wave; the sound we hear is a wave; every musical instruments works by waves. In fact, waves have applications in almost every field of everyday life – from wireless communications to detecting over speeding vehicles, from the music of guitars to lasers – almost every aspect of our everyday life in some way involves wave.

In this module, you will find out how these waves behave and what enable them to carry energy from one point to another. Remember to search for the answer to the following questions:

1. What are waves and its different types?
2. What are the different characteristics of waves and how these affect the behavior of waves?
3. What are sounds and its characteristics?
4. How do waves and sounds behave in a given condition?

LESSONS AND COVERAGE:

In this module, you will examine this question when you take the following lessons:

Lesson 2.1 –Types and Characteristics of Waves

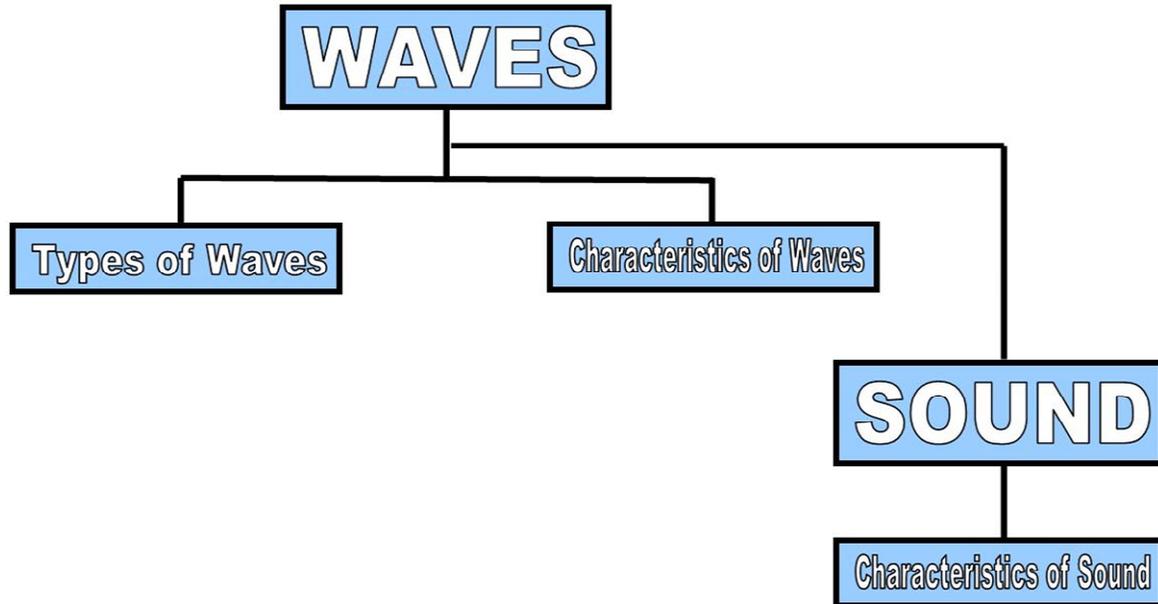
Lesson 2.2 –Characteristics of Sound

In these lessons, you will learn the following:

<i>Lesson 2.1</i>	<ol style="list-style-type: none"> 1. Identify and differentiate the types of waves and their behavior. 2. Enumerate some examples of different types of waves and analyze how each type behaves. 3. Familiarize with the characteristics of waves. 4. Predict the possible behaviors of waves by investigating its different characteristics.
<i>Lesson 2.2</i>	<ol style="list-style-type: none"> 1. Familiarize with the characteristics of sound. 2. Predict the possible behaviors of sound by investigating its different characteristics.

MODULE MAP:

Here is a simple map of the above lessons you will cover:



EXPECTED SKILLS:

To do well in this module, you need to remember and do the following:

1. Read the instructions carefully before starting anything.
2. Complete all the activities and worksheets. Follow instructions on how to submit them.
3. Look up the meaning of words that you do not know.
4. You will frequently come across process questions as you go through different lessons. Keep a notebook (or use the Notepad) where you can write (and revise) your answers to these questions. Use also the notebook to jot down short notes, draw diagrams and summarize what you have just read.
5. For worksheets and reports that need to be submitted, use the provided checklist and rubric to evaluate your work before submission.
6. Allow time for relaxation and recreation when you are mentally tired. Make a time table to schedule your study and recreation.

PRE-ASSESSMENT:

Let's find out how much you already know about this module. Click on the letter that you think best answers the question. Please answer all items. After taking this short test, you will see your score. Take note of the items that you were not able to correctly answer and look for the right answer as you go through this module.

1. Which of the following statements is true about waves?
 - A. As a wave moves through a medium, the individual particles of the medium moves from the source of the wave to another location some distance away.
 - B. Waves are a means of transporting energy from one location to another without actually displacing matter from one location to another.
 - C. An ocean wave will transport ocean water from near the middle of the ocean to a location near the shore.
 - D. Sound causes the air molecules to travel from one point to another.

2. Waves have the property to reflect or bounce off walls and other obstacles. Which of the following situations depicts this property?
 - A. An echo
 - B. A straw appears bent in water
 - C. A sound waves spread out to travel around the corner
 - D. A stone thrown in the water creating numerous ripples

3. Your teacher attaches a slinky to the wall and begins introducing pulses with different amplitudes. Which of the two pulses below will travel from the hand to the wall. in the least amount of time? Justify your answer.



- A. Wave A because the speed of the wave depends on the size of its amplitude, the higher the size of amplitude, the faster the movement of the wave.
- B. Wave B because the speed of the wave depends on the size of its amplitude, the lower the size of amplitude, the faster the movement of the wave.
- C. They will reach the wall at the same time because the speed of the wave does not depend on its amplitude but on the nature of its medium.
- D. The information given was not sufficient to answer the question because aside from the amplitude, the information about the wave length is also needed.

4. A crowd in a stadium wants to create a longitudinal stadium wave. Describe how the fans must move to achieve the said kind of wave.
 - A. The fans must stand and sit consecutively
 - B. The fans must move their bodies forward and backward.
 - C. The fans must sway their bodies from left to right.
 - D. The fans must turn their bodies clockwise or counter clockwise.

5. John accidentally strikes the flag pole in his school while playing baseball. The ball hit the pole horizontally. How would you describe the waves in pole?
 - A. The particles vibrate horizontally along the direction of the rod.
 - B. The particles vibrate vertically, perpendicular to the direction of the rod.
 - C. The particles vibrate in circles, perpendicular to the direction of the rod.
 - D. The particles travel along the rod from the point of impact to its end.

6. Michelle idolizes Scotty McCreery of American idol a lot because of his very low-toned voice. For her, his voice is very unique for not all singers are able to hit those low notes. How would you describe the voice of Scotty in terms of its frequency?
 - A. The frequency of the voice is very low.
 - B. The frequency of the voice is very high.
 - C. The frequency of the voice is changing from low to high.
 - D. The frequency of the voice cannot be determined because of the lack of information.

7. Michael keeps on complaining about the noise he hears in the building being constructed near his house. He always whines about the loud and heavy sound coming from the equipment used in the construction. How would you describe the sound wave based of what Michael is experiencing?
 - A. The amplitude of the sound is very high.
 - B. The frequency of the sound is very high.
 - C. The intensity of the sound is very low.
 - D. The vibration of the sound is very low.

8. Explain why sound is considered as a mechanical wave and not an electromagnetic wave.
 - A. Sound waves need a medium to travel and transport energy.
 - B. Sound waves travel faster in closely packed molecules than those who are partially loose.
 - C. Sound wave sound waves produces a compression pressure to the air molecules making them vibrate and transfer energy
 - D. Sound waves can be easily diffracted by any obstacles.

9. Grace observed that ocean waves continue to splash onto the shore yet the beach is not completely submerged nor the middle of the ocean is depleted of its water. Which of the following statements can explain the phenomenon observed by Grace?
 - A. Waves coming from the other bodies of water carries sufficient amount of water to avoid the depletion of water at its middle.

- B. The water waves carried to the shore will eventually go back to the ocean by passing through underground ducts.
 - C. Waves doesn't actually move the water in the middle of the ocean to the shore they simply transfer their energy from one place to another.*
 - D. The water from the underground sources finds its way through the vents lying in the ocean floor supplying enough water to prevent water loss.
10. Noah is practicing to play the organ pipe. It is known to him that the characteristics of the sound from the organ depends on the manner it is blown. Which of the following statements will occur if Noah blew the organ pipe slightly harder than the usual?
- A. The frequency of the wave will be greater because the amount of energy put into the wave is directly proportional to its frequency.
 - B. The wavelength would be shorter because the higher the energy put into the wave, the shorter its wavelength would be.
 - C. The speed of the wave produced will be faster because the energy given by the person helps the wave to travel faster.
 - D. The amplitude of the wave will be greater, because the energy is related to the wave's amplitude, the higher the energy, the greater its amplitude.
11. A small tectonic movement occurred in the seafloor of the Pacific Ocean producing series of water waves. The waves travel from deep water to shallow water before reaching the surface of the ocean. Which of the following statements explains the change in the behavior of the waves as it travels from the deep to shallow water?
- A. The wavelength is shorter in shallow water and longer in deep water.
 - B. The wavelength is longer in shallow water and shorter in deep water.
 - C. The frequency is lower in shallow water and higher in deep water.
 - D. The frequency is higher in shallow water and lower in deep water.
12. Christian watches a science fiction movie and one of the scenes involves a spaceship battle in outer space. Spaceship A launches a successful strike on spaceship B. The scene is presented from the perspective of spaceship A. The occupants of spaceship A view spaceship B blowing up as the result of the successful missile strike. They see the flames of the explosion and shortly thereafter hear the thunderous sound of the explosion. Mike, as a physics student, immediately noticed something wrong about the scene. Which of the following statements explains what Christian noticed wrong in the movie?
- A. The occupants in spaceship A shouldn't be able to hear the explosion because of the thin atmospheric condition in the space.
 - B. The occupants in spaceship A shouldn't be able to hear the explosion because the universe is considered as a vacuum space.
 - C. The occupants in spaceship A shouldn't be able to hear the explosion because of the reflection of sound waves through asteroids and other celestial bodies.

- D. The occupants in spaceship A shouldn't be able to hear the explosion because of the magnetic forces from the planet that oppose the direction of sound waves.
13. A mechanical wave must need a medium for it to travel from one place to another. The speed of the wave depends on the characteristics of its medium, the closer the particles to each other, the faster the speed of the wave. Based on the given information, how would you explain the transport of wave from point to another?
- A. The particles of the medium are frictionless allowing the wave to pass through from one particle to another with ease.
 - B. The particles of the medium are isolated to each other allowing the wave to enter without hindrances.
 - C. The particles of the medium are able to interact to each other making the transfer of wave energy from one particle to another.
 - D. The particles of the medium are very light making them easier to flow from one place to another.
14. Margaret is a famous opera singer of her generation. It is said that her voice is so unique that it can actually break thin crystal glasses. Which of the following statements will explain the probability of breaking thin glasses using only the person's voice?
- A. The person's voice can break glasses if the sound produced has the same natural frequency with the glass.
 - B. The person's voice can break glasses if its pitch is higher than what is normal.
 - C. The person's voice cannot break glasses because it will need much more energy to break something using only sound waves.
 - D. The person's voice cannot break glasses because the sound wave cannot reach the natural frequency of something that is solid.
15. Hurricanes cause tremendous destruction to homes and businesses. But along and near the coast, what is the single biggest threat to life from these storms?
- A. Rain
 - B. High winds
 - C. Storm surge
 - D. Tornadoes
16. What is frequently a warning sign of an impending tsunami?
- A. Winds suddenly change direction
 - B. The sky suddenly clears
 - C. Seawater suddenly retreats from the shore
 - D. All of the above
17. What is frequently a warning sign of an impending tsunami?
- A. Winds suddenly change direction
 - B. The sky suddenly clears
 - C. Seawater suddenly retreats from the shore

- D. All of the above
18. Storm surges are ocean waves with heights that can reach up to 40 kilometers and can devastate a whole town in less than a minute. Which of the following statements explains the formation of storm surges?
- A. It is formed when the moon is located at the nearest point to the earth creating a greater gravitational pull to earth's ocean resulting to formation of abnormally high ocean waves.
 - B. It is formed by the simultaneous movement of big shipping boats and marine animals displacing a large amount of water bringing them to the shore in the form of waves.
 - C. It is formed by transferring the energy of the wind to the surface of water creating a wave. If the speed of the wind increases beyond the normal level, the height of the waves formed will abnormally increase.
 - D. It is formed by the movement of seafloor or underwater volcanic activities. These movements in oceanic crust create a large displacement of water in the ocean that leads to the formation of large waves.
19. The following natural phenomena can trigger a large tsunami except_____.
- A. Earthquake
 - B. Typhoons
 - C. Volcanic eruptions
 - D. Undersea landslides
20. The residents in a coastline were given a lecture about different precautionary measures that should be done before, during and after the tsunami. It was mentioned in the lecture that the residents should immediately leave the coastline once they felt a certain occurrence. Which of the following occurrences should trigger the residents to leave the coastline?
- 1. A. An earthquake is felt near a susceptible coastline area
 - 2. B. The ocean begins to recede, showing the ocean floor
 - 3. C. A tsunami siren is heard
 - 4. D. A giant wall of water is seen moving towards the beach
21. A tsunami is always associated with earthquakes. Which of the following statements best explains how earthquakes cause tsunamis?
- A. Earthquakes shift the sea floor up or downward, causing water to be displaced.
 - B. Earthquakes shake the water, causing the ripples to move outward in all directions.
 - C. Earthquakes cause a release of gas on the seafloor that causes water to be displaced.
 - D. Earthquakes heat ocean water, causing it to expand and move as a wave.



EXPLORE

Let's start this module by watching the following video:

Activity 1: Stone Skipping

Watch the following video about stone skipping. Take note of the things that happen in a stone-skipping competition. Give extra attention to the things that happen to the water during stone-skipping.

<https://www.youtube.com/watch?v=kr8HgLa-ELA>

Process Questions:

1. What are the things that need to be considered in stone skipping?
2. What happened to the water surface of the river during stone skipping?
3. What do you think is the cause of these disturbances in the water surface?

Activity 2: Eliciting Prior Knowledge Through I-R-F CHART

In the previous activity, you were instructed to focus on the disturbances that occur in the river surface during stone-skipping. These disturbances are called WAVES. Now, it's time to give your initial knowledge about waves by answering the following question. Given below is an IRF chart, fill in the first column with your answer to the question:

How do waves affect the flow of energy?

Initial	Revised	Final

END OF EXPLORE:

You just tried finding out how waves formed and behave in certain conditions and their ability to carry something from one place to another.

Let's find out how your other classmates answered the first column of the IRF chart. You can make use of the *Discussion Forum* to communicate with your classmates. Compare their ideas to your own.

What you learn in the next sections will also enable you to do the final project which involves creating a presentation with a model that you created about how water waves like storm surges behave.

Let's start gathering information by proceeding to the next part.



FIRM-UP

Your goal in this section is to learn and understand the formation of waves, their characteristics and their behaviors.

Activity 3: Video Analysis

Watch the following video about how water ripples are formed and what causes its formation. Take note of how the ripples move and its behavior.

<http://www.youtube.com/watch?v=-DdSGOCCFpE>

Process Questions:

1. In the video, describe how the ripples are formed in the water.
2. Explain the movement of the ripples from one point to another. Do you think this movement enables these ripples to carry or move something from one place to another? Discuss.

Activity 4: Article Reading

You have been introduced to a simple example of waves, which is in the form of water ripples. Now read the following article to have an idea what these waves are and how they behave. The article also presented examples of waves and wavelike motion. Be sure to jot down important concepts and ideas to help you in answering the proceeding questions.

Waves and Wavelike Motion

<http://www.physicsclassroom.com/class/waves/Lesson-1/Waves-and-Wavelike-Motion>

Process Questions:

1. What are waves?
2. Give some examples of waves and wavelike motions discussed in the article.
3. What is the importance of these waves in our life?

Activity 5: What is a Wave and Its Properties?

To understand more about how waves behave, we must first identify and describe the different characteristics of waves and how these may affect the waves' behavior.

Click on the video link that discuss about waves, its characteristics and applications. Make sure to jot down important notes and terminologies that you may encounter in these websites. Answer also the sample quizzes that you will find at end of every lesson.

<https://www.youtube.com/watch?v=uJZInFSUXt4> – Bill Nye the Science Guy - Waves

Process Questions

1. Based on the video, what is a wave?
2. What are the terms that you gathered? Do the terms sound familiar?
3. What can help you more easily remember these terms? Look back at your notes and try to cluster related concepts.
4. What are the important concepts and properties of waves that are presented in the activity?
5. How are these properties affect the way waves behave?
6. Give example of a real-life example of wave and briefly discuss its properties and behavior.

Activity 6: “FRY YOUR WAVES” – A Frayer Model of Waves

Below is a Frayer model of waves. Based on the things that you have encountered in the previous activities, correct some errors and inaccuracies that you can find. Defend your answer by providing proper explanation below the model.

<p>Definition</p> <p>A disturbance or oscillation (of a physical quantity), that travels through matter or space, accompanied by a transfer of energy.</p>	<p>Characteristics</p> <ul style="list-style-type: none"> • Amplitude: the height of the wave, measured in meters. • Wavelength: the distance between adjacent crests, measured in meters. • Period: the time it takes for one complete wave to pass a given point • Frequency: the number of complete waves that pass a point in one second.
<h1>WAVES</h1>	
<p>Examples</p>   	<p>Non-examples</p>   

Process Questions:

1. What are the things that you found wrong in the graphic organizer above? Explain the correction that needs to be done.
2. Can you give your own examples and non-examples of waves?

Activity 7: Categories of Waves

Let's further examine more about waves by reading the following article below about the different categories of waves and their differences.

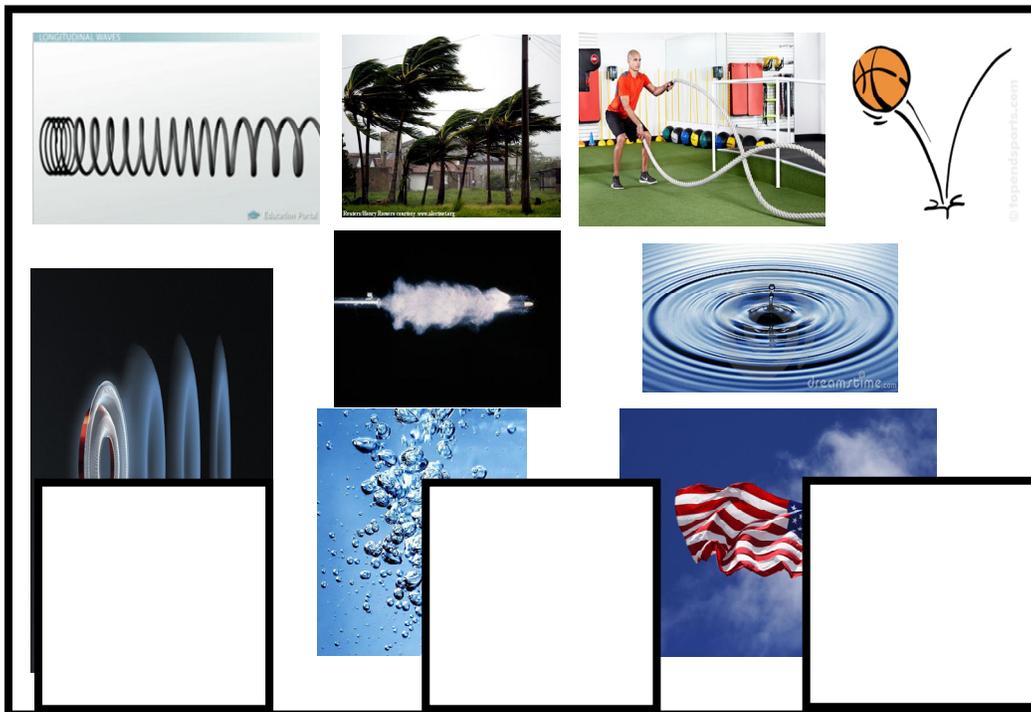
<http://www.physicsclassroom.com/class/waves/Lesson-1/Categories-of-Waves> - Categories of Waves

To reinforce the concepts you acquired after reading the article, click on the following video about the different categories of waves, their differences and examples. Make you sure to take down important notes and terms that you might need for further studies.

<https://www.youtube.com/watch?v=aH5r4ZTOXS4> – Categories of Waves and their Examples

Process Questions:

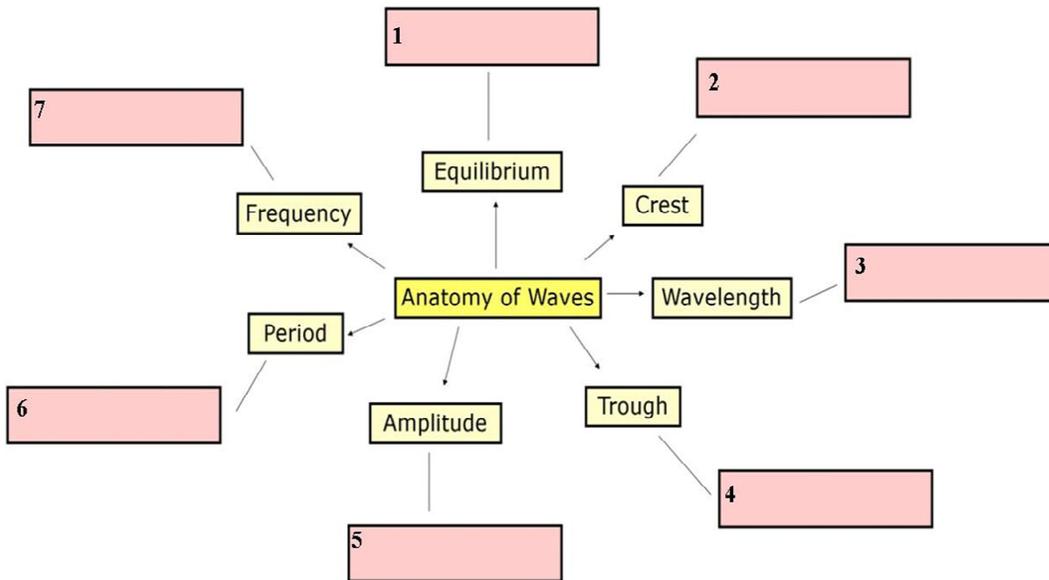
1. How are waves categorized? What are the bases of such categorization?
2. What are the different types of waves and how are they differ from one another?
3. Below is a pool of pictures. Identify examples of waves and classify them as transverse or longitudinal. Defend your answer in the space provided.



_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

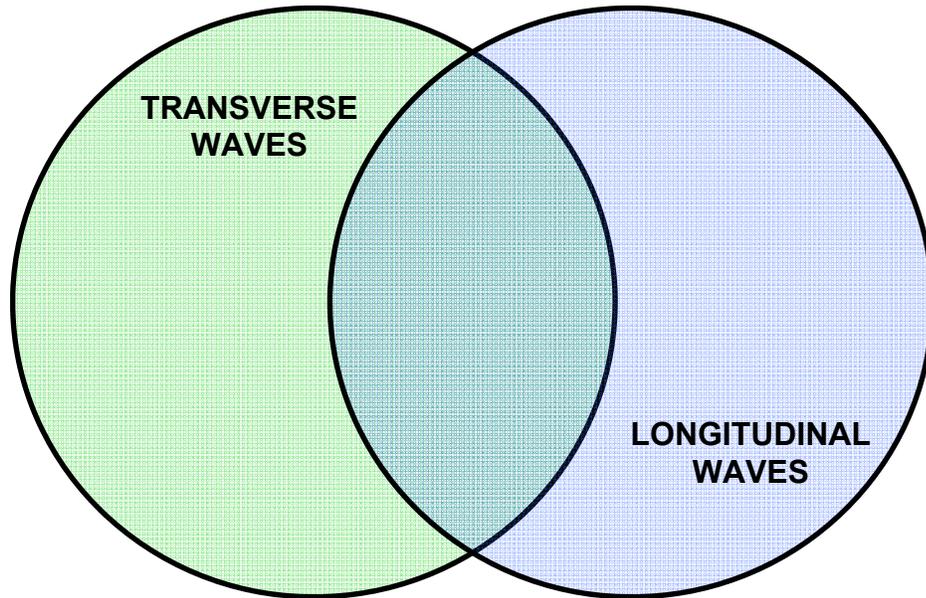
Activity 8: Graphic Organizer

Based on the websites that you read in the previous activity, fill in the following organizer about the anatomy of waves. Double-check your answers before submitting it your teacher.



Activity 9: Venn Diagram

It's time to bring out all the information you have gathered from your previous activities. Fill in the following Venn diagram about the two types of waves. Enumerate their similarities and differences.



Activity 10: Webpage Reading

Let's level up a little by considering not only the waves themselves but also the things that may happen around them. Click on the following websites and read the lecture about how waves interact with its outside environment. Take note of the important terminologies and concept that you will encounter in the lecture. <http://www.physicsclassroom.com/class/waves/Lesson-3/Reflection,-Refraction,-and-Diffraction> – Reflection, Refraction and Diffraction of Waves

Focus Questions:

1. What are the differences between reflection, refraction and diffraction of waves?
2. Can you give real-life situation of the wave interaction mentioned in the lecture?

Activity 11: Animation/Video Viewing

Let's take to another level. The following video will help you visualize the concepts you have so far learned.

Watch the animations found in the links given below:

- <http://www.youtube.com/watch?v=yd-G6KYwzVA> – Types of Waves
- <http://www.youtube.com/watch?v=X1OGiWPq5j8> – Properties of Waves
- <https://www.youtube.com/watch?v=Xm49vEL6ca4> – Video about Surfing

After watching, try to find the answers to the following questions:

1. What were the videos about?
2. What were the terms that were emphasized in the videos? How are the terms related to the behavior of waves?
3. In the third video about surfing, using the terms given the previous videos, explain how ocean waves can carry tremendous amount of energy from one place to another. Situation?

Activity 12: Check-Up Quiz

Review the terms and concepts learned in the previous activity by taking the online quiz found in the link below.

<http://www.softschools.com/quizzes/science/waves/quiz343.html> - Online Quiz about Waves and its Characteristics.

How did you perform in the quiz? Look at the items you missed. Go back to your notes and review the terms or concepts you missed.

Activity 13: 3-2-1 Chart

It is now time for you to do an assessment of your progress in this module. Accomplish this 3-2-1 chart then submit it to your teacher.

3	<i>Things You Learned</i>	
2	<i>Things You Need to be Clarified</i>	
1	<i>Things You Want to Explore More</i>	

Activity 14: Revising Prior Knowledge Through IRF Chart

Go back to the question: *How do waves affect the flow of energy?*

Write your revised answers to this question in the R column of the IRF chart.

Initial	Revised	Final

END OF FIRM UP:

In this section, the discussion was all about the types and characteristics of waves.

Go back to the previous section and compare your initial ideas with the discussion. How much of your initial ideas are found in the discussion? Which ideas are different and need revision?

Now that you know the important ideas about this topic, let's go deeper by moving on to the next section.



DEEPEN

Your goal in this section is to take a closer look at some aspects of waves and its real-life applications.

Activity 15: Video Analysis

The following video will give you a deeper understanding about the behavior of waves and their ability to transport energy from one place to another. Take note of the important terms and concepts that will be discussed in the video.

<http://www.youtube.com/watch?v=kIdESF0OwTo>

Process Questions:

1. What will happen if two or more waves interact with each other?
2. What do you think is the importance of knowing the different ways waves can interact with one another?
3. Do you think the properties of waves affect the way they interact with one another? Explain.
4. How do these wave interactions transport energy from one place to another?

Activity 16: Wave Interactions in Our Life

Now that you have learned everything about how waves work and interact with one another, let's now see how all these things apply in our daily lives. The links below give us the different practical applications of the three kinds of wave interactions: Reflection, Refraction and Diffraction. Read and analyze the application and take note of how different wave properties are applied in these applications.

Application of Wave Reflections

<http://cikguwong.blogspot.com/2012/03/physics-form-5-chapter-1-application-of.html>

<http://www.tutorvista.com/content/physics/physics-i/wave-motion-sound/reflection-sound.php>

Application of Wave Refractions

<http://www.s-cool.co.uk/gcse/physics/properties-of-waves/revise-it/refraction-of-waves>

<http://hyperphysics.phy-astr.gsu.edu/hbase/sound/refrac.html>

Application of Wave Diffractions

<http://www.scienceclarified.com/everyday/Real-Life-Physics-Vol-2/Diffraction-Real-life-applications.html>

<http://hyperphysics.phy-astr.gsu.edu/hbase/sound/diffrac.html>

Process Questions:

1. What are the different applications of wave interactions that were mentioned in the links?
2. How are the different wave properties shown in these applications?
3. Cite other applications of how waves interact with their environment.

Activity 17: Summarizing Ideas

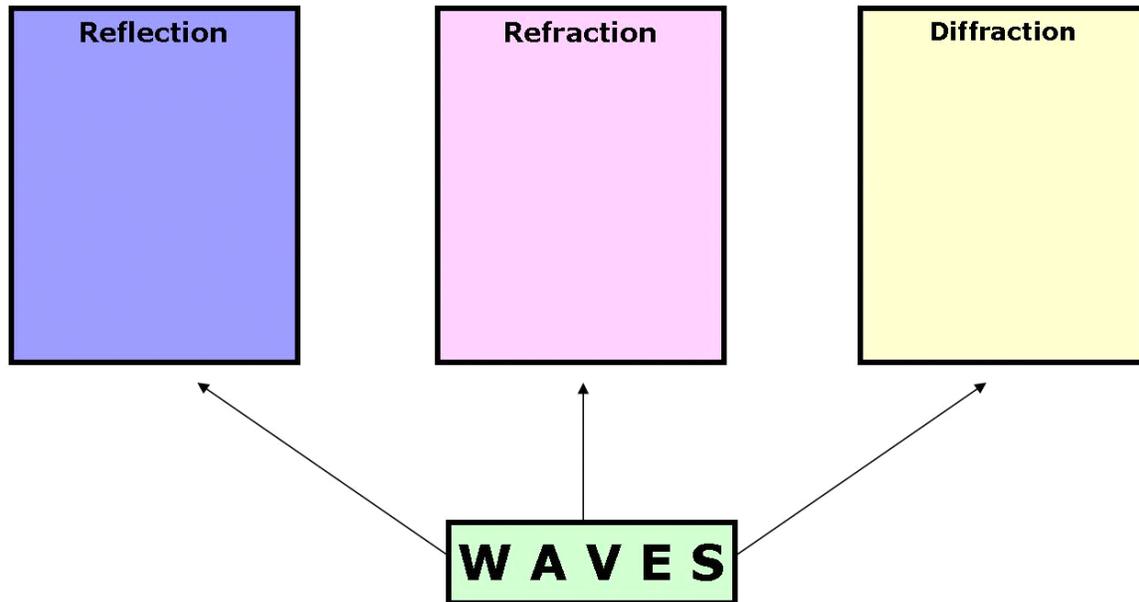
After knowing the applications of wave interaction, it's now time to summarize your ideas. Click on the videos to learn more about how waves behave, interact with one another and carry or transport energy.

https://www.youtube.com/watch?v=7oA_zLpJItE – Reflection of Waves

<https://www.youtube.com/watch?v=5OirsBNFHBs> – Refraction of Waves

<https://www.youtube.com/watch?v=-mIO9jqJyyI> – Diffraction of Waves

Below is an organizer that will help you to summarize the concept you've learned from the activity. You may also refer to your notes from the previous activity about the behavior of waves. Fill it in and submit your answers to your teacher.



Activity 18: Wave Application – Sound

Below are different activities about the nature and characteristics of sound waves. Click on the following links to have an understanding about the importance of sound and its applications.

Sound is a Mechanical Wave

<http://www.physicsclassroom.com/class/sound/Lesson-1/Sound-is-a-Mechanical-Wave>

Process Questions:

1. How can you describe a sound wave?
2. What are some of the defining characteristics of a sound wave?

Sound as a Longitudinal Wave

<http://www.physicsclassroom.com/class/sound/Lesson-1/Sound-as-a-Longitudinal-Wave>

Process Questions:

1. Based on the article, how are sound waves produced?
2. What is the reason why sound waves are classified as longitudinal waves?
3. How would you differentiate sound waves from the waves produced by ropes?
4. In what way do you think sound can transfer energy from one place to another?

Application of Sound Wave

<https://www.youtube.com/watch?v=GkNJvZINSEY>

Process Questions:

1. What are the different applications of sound waves presented in the video?
2. Cite other applications of sound waves in everyday life.

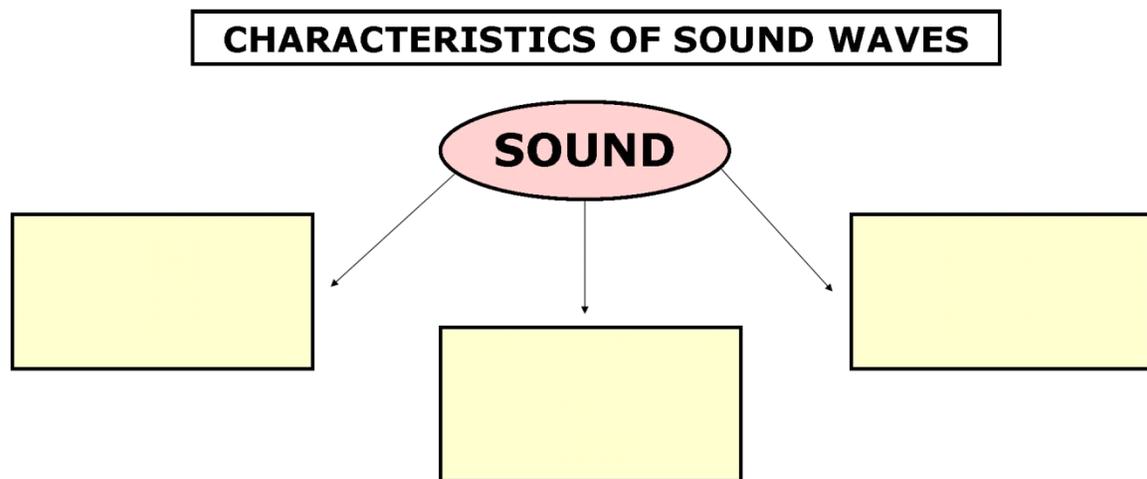
Sound Wave Animation

http://www.iknowthat.com/ScienceIllustrations/sound/science_desk.swf

Process Questions:

1. What are some examples of sound waves presented in the animation?
2. In the animation, what are the things that may affect the behaviors and properties of the produced sound wave?

Let us summarize the basic concepts in the articles that you have read by filling in the concept map below about three basic characteristics of sound waves.



Activity 19: Webpage Reading: Sound Waves

Click on the following link and read the lecture about sound waves. The website will give you a more detailed explanation about sound waves. Take note of the terminologies and concepts that you will encounter upon reading the lecture.

http://www.studyphysics.ca/newnotes/20/unit03_mechanicalwaves/chp141516_waves/lesson49.htm

Focus Question:

1. What are some of the properties of sound waves that were discussed in the lecture?
2. How do you think these properties help sound waves be unique among other waves?

3. Do you think these properties affect the ability of sound waves to transport energy from place to another? Explain.

Activity 20: The Sound of Science

The video link below directs you to different simple experiments regarding sounds and its ability to transport energy. Compare and contrast the different sounds produce by different means.

<https://www.youtube.com/watch?v=7VGIBZOywlq> – Cool Science Experiments on Sounds

https://www.youtube.com/watch?v=uENITui5_jU – Amazing Water and Sound Experiment

Process Questions:

1. What can you say about the different experiments done with sound waves?
2. How can you relate the different properties of sounds waves to the experiments presented?

Activity 21: Levitate with Sound

Let's further deal with how sound can interact with its outside environment. The video below shows you how sound waves can levitate objects and let the objects stay in mid-air. Study how the experiment is done and relate it with the properties of sounds that you have learned.

<https://www.youtube.com/watch?v=odJxJRAxdFU> - Three-Dimensional Mid-Air Acoustic Manipulation

Process Questions:

1. Based on your observation, what enables the sound waves to levitate different small objects?
2. What are the properties of sound that are involved in the video? Discuss how these properties are essential in the experiment.

Activity 22: Manipulating Sound

Now it's time for you to manipulate your own sound! The links below enable us to create sound waves and manipulate their properties. Take note of the changes in the structure of the waves as you change one property and another.

<http://scratch.mit.edu/projects/45914566/>

http://www.iknowthat.com/ScienceIllustrations/sound/science_desk.swf

Process Questions:

1. What properties of sound waves were you able to change in animations?
2. What happened to the waves as you change one property?

3. How would these properties affect the structure and behavior of sound waves?

Activity 23: Essay Writing

Now that you know the basic properties and characteristics of sound waves, let us now level up your thinking about these waves.

Write an essay about the different practical applications of sound waves in our life. Focus on the following areas: Everyday lifestyle, Technology and Medicine.

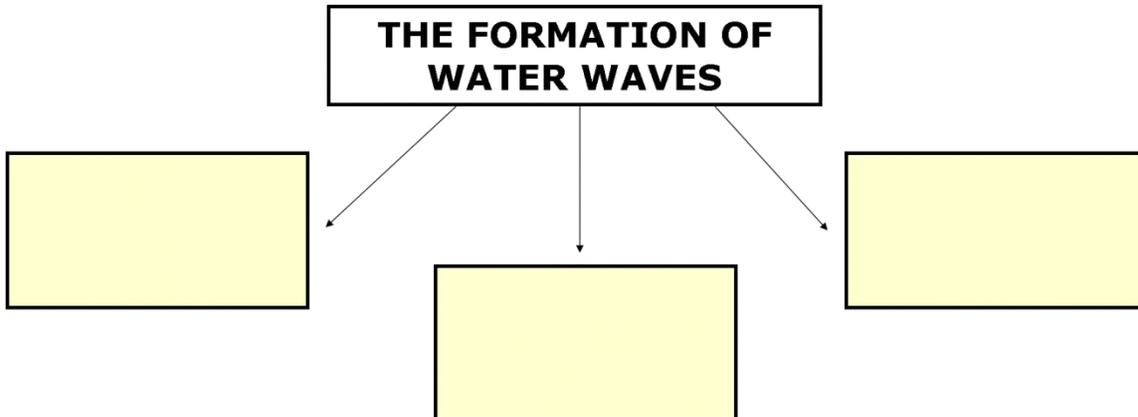
You may browse the net or use books to gather needed information.

Activity 24: Real Waves: Water Waves

Another real-life applications of waves are the water waves. Click on the following link to know about water waves and how they formed. Take note of the important things that you may encounter in the video.

<https://www.youtube.com/watch?v=HvklXnAAoHA>

Fill in the following concept map to summarize the information that you gathered from the video.



Activity 25: Waves of Destruction: Tsunami

Tsunami is an example of water waves that can cause calamities and destructions in a certain place. Watch the following about the effects of these water waves in a community, especially those who are found near the coastal areas.

<https://www.youtube.com/watch?v=RDOuwMj7Xzo> – The 2004 Boxing Day Tsunami

Process Questions:

1. How do you feel about the video presented above?
2. What can you say about the effects and the damages caused by the tsunami in the video?
3. How do you think these tsunamis are able to do such destruction? Where do you think the energy came from? Explain.
4. What do you think can you do to help prevent this kind of disaster to happen again?

Activity 26: Getting Informed About Tsunami

The link below explains how tsunamis are formed. Study the animation to better understand the behavior of tsunamis.

<https://www.youtube.com/watch?v=SlwZzbGh7Cw>

Process Questions:

1. In the video, what causes a tsunami? What do you think is the importance of knowing such thing?
2. How would the things you've learned from the previous activities help you prepare for such disaster?

Activity 27: Webpage Reading: Tsunami

The following links will give you a deeper understanding about tsunamis. Read the websites and jot down important notes that you may encounter.

<http://academic.evergreen.edu/g/grossmaz/springle/> - Formation of Tsunamis

<http://news.nationalgeographic.com/news/2007/04/070402-tsunami.html> -

Precautionary Measure about Tsunamis

Process Questions:

1. What were the different ways of how tsunamis may form?
2. What are the things that people in the coastal area must do during a tsunami?
3. What do you think is the importance of following these precautionary measures about tsunamis?

Activity 28: My Learning Checklist

Now that you have finished most of the activities in this module, it's time to check the things that you've learned. Below is a table for the skills that you have to acquire after finishing this module. Write YES if you did acquire the objective, otherwise, write NO.

5. LEARNING SKILLS	6. YES	7. NO
1. Identify and differentiate the types of waves and their behavior.	8.	9.

2. Enumerate some examples of different types of waves and analyze how each type behaves.	10.	11.
3. Familiarize with the characteristics of waves.	12.	13.
4. Predict the possible behaviors of waves by investigating its different characteristics.	14.	15.
5. Familiarize with the characteristics of sound.	16.	17.
6. Predict the possible behaviors of sound by investigating its different characteristics.	18.	19.

Activity 29: Revising Prior Knowledge Through IRF Chart

Go back to the question: *How do waves affect the flow of energy?*

Write your revised answers to this question in the Final column of the IRF chart.

Initial	Revised	Final

END OF DEEPEN:

In this section, the discussion was about a specific type of wave, which is the sound wave. You also learned about a type of real wave called water waves and their effect on a community, specifically the coastal areas.

What new realizations do you have about the topic? What new connections have you made for yourself? What helped you make these connections?

Now that you have a deeper understanding of the topic, you are ready to do the tasks in the next section.



TRANSFER

Your goal in this section is apply your learning to real life situations. You will be given a practical task which will demonstrate your understanding.

Activity 30: Hazard Assessment

Now that you understand the mechanisms in the development of tsunamis, the next set of activities will assess how you can apply your understanding to risk assessment and reduction.

Fill in the following worksheet as your guide in completing this activity.

Precautionary Measure Worksheet

PRECAUTIONARY MEASURES ON TSUNAMIS		
<i>Before</i>	<i>During</i>	<i>After</i>

--	--	--

Process Questions:

1. Do you need to prepare for every calamity that enters the Philippine Area of Responsibility? When should you prepare for it?
2. Who should prepare for a calamity?
3. Why prepare for a calamity? How should you prepare for it?
4. What should you keep in mind before a calamity hits your community?

Activity 31: Exploring a New Threat: Storm Surges

Aside from the tsunamis, another type of water wave that can actually create a great destruction upon a community, these are called storm surges.

Below are links that can give you important information about storm surges.

http://www.stormsurge.noaa.gov/overview_formation.html - Formation of Storm Surges

<http://www.bom.gov.au/cyclone/about/stormsurge.shtml> - Effects of Storm Surges

Process Questions:

1. What are storm surges?
2. What are the things that can trigger to the formation of storm surges?
3. How can you ensure the safety of a community during a storm surge?

ACTIVITY 32: Transfer Task: Preparing a Presentation for Storm Surge

Information Drive

The Visayan Region was hit by the super typhoon named “Yolanda” last 2013. The damage was extensively large and was magnified by the formation of numerous “storm surges” during the typhoon. The residents weren’t prepared about the presence of these storm surges and how they behave resulting to greater damage and casualties.

You are a scientist hired by the Department of Interior and Local Government to produce a simple model that will give information of how these storm surges behave and what may trigger its occurrence. You have to prepare a 10-minute presentation with a model that you created to imitate the movement of these waves.

Your presentation will be evaluated based on its organization, content, visuals and delivery.

Criteria	Outstanding 4	Satisfactory 3	Developing 2	Beginning 1
-----------------	-------------------------	--------------------------	------------------------	-----------------------

Organization	Student presents information in a logical and interesting sequence which audience can follow.	Student presents information in logical sequence which audience can follow.	Audience has difficulty following presentation because student jumps around.	Audience cannot understand presentation because there is no sequence of information.
Content Knowledge	Student demonstrates full knowledge (more than required) with in-depth explanations and elaboration.	Student show sufficient knowledge of content	Student is inaccurate in certain parts and is able to answer only rudimentary questions.	Student does not have grasp of all information; student cannot answer questions about subject.
Visuals	Student used visuals to reinforce and enhance screen text and presentation.	Visuals related to text and presentation.	Student occasional used visuals that rarely support text and presentation.	Student used no visuals.
Delivery	Student used a clear voice and showed commanding stage presence	Student's voice is clear. Student showed confidence in speaking	Student was not easily heard or understood in certain parts. Student incorrectly pronounces terms. Audience members have difficulty hearing presentation.	Student mumbles and speaks too quietly for students in the back of class to hear.

END OF TRANSFER:

How did you find the performance task? How did the task help you see the real world use of the topic? Write a **reflective journal** of your experiences and the things you learned about the task.

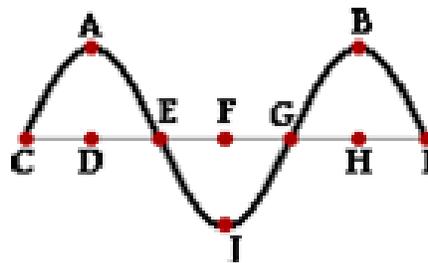
You have completed this lesson. Before you go to the next lesson, you have to answer the following post-assessment questions.

POST-ASSESSMENT

It's now time to evaluate your learning. Click on the letter of the answer that you think best answers the question. Your score will only appear after you answer all items. If you do well, you may move on to the next module. If your score is not at the expected level, you have to go back and take the module again.

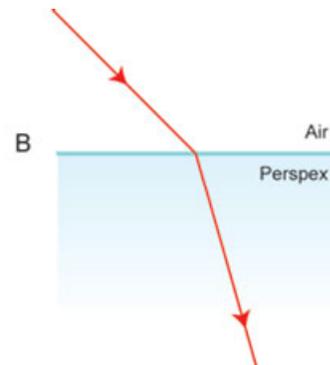
1. If the particles of the medium are vibrating to and fro in the same direction of energy transport, then the wave is a _____ wave. (K)
 - A. Longitudinal
 - B. Sound
 - C. Standing
 - D. Transverse

2. Your teacher asked you to create a transverse wave using a rope tied in a pole. The following illustration can be used as a depiction of a wave that you would possibly produced. The diagram is labeled with different letters indicating the different parts of the wave. Describe how the particles of the medium vibrate in a transverse. (P)



- A. Parallel to the line joining AD
 - B. Along the line joining CI
 - C. Perpendicular to the line joining AD
 - D. At various angles line CI
-
3. The wavelength of a wave is the distance between two corresponding points a wave while frequency of a wave is the number of times per second that a wave cycles. How are these two quantities related? (P)
 - A. The greater the frequency, the greater the wavelength
 - B. The greater the frequency, the smaller the wavelength
 - C. Wavelength is equal to the frequency
 - D. There is no connection between wavelength and frequency

4. A light wave travelling from one medium to another may differ in its speed. The diagram below show the difference that the light wave will undergo once this phenomenon happen. Which of the following behavior of waves explains this scenario? (K)



- A. Reflection
- B. Refraction
- C. Diffraction
- D. Interference

5. Joan is preparing for an event this coming Friday. She wants to make sure that the sound system in the event is loud enough for the whole crowd to hear the music. Which of the following properties of sound does Joan have to take in consideration to make a sound louder? (K)

- A. Frequency
- B. Amplitude
- C. Wavelength
- D. Pitch

6. Pitch is a property of sound that depends on its frequency. Describe the wavelength of a sound with a high pitch like that of a baby. (K)

- A. The wavelength is close together
- B. The wavelength is far apart
- C. The wavelength is equal to one another
- D. The wavelength cannot be determined by the given data.

7. Michael is trying to create sounds by plucking some rubber bands. If Michael wants to produce a sound with high frequency, which of the following things should Michael do?

- A. Stretch the rubber band tight to produce a higher pitch
- B. Pluck the rubber band faster to increase the amplitude
- C. Make the rubber band thicker by combining it with other rubber bands.
- D. Strike the rubber band harder to increase its frequency.

8. Which of the following statements is not true about sound waves?
- A. A sound wave is a mechanical wave.
 - B. A sound wave is a means of transporting energy without transporting matter.
 - C. Sound can travel through a vacuum.
 - D. A sound wave is a pressure wave; they can be thought of as fluctuations in pressure with respect to time.
9. Josh is making waves on a spring in different possible ways. He keeps record on the changes that happen to the wave every time he changes the way he produces it. In a mean time, he notices that there is one property of a wave that is not changing. Which of the following property is that?
- A. Amplitude
 - B. Frequency
 - C. Velocity
 - D. Wavelength
10. A medium is important for a mechanical wave, like sound, to travel. The medium enables waves to transfer energy from one place to another without transporting the matter itself. Which of the following statements explains why mediums are able to do such thing?
- A. The particles of the medium are frictionless.
 - B. The particles are isolated to one another
 - C. The particles are able to interact with one another.
 - D. The mass of the particles are very light and almost negligible.
11. Minute after minute, hour after hour, day after day, ocean waves continue to splash onto the shore. Explain why the beach is not completely submerged and why the middle of the ocean has not yet been depleted of its water supply.
- A. The water in the middle of the ocean. is not depleted because the water is travelling underneath replacing the water in the middle.
 - B. Ocean waves are not able to transport water. The waves are only capable of transporting energy.
 - C. Underground waters are used to replace the water loss in the middle part of the ocean.
 - D. Ocean shores absorbed the water in the shore preventing the overflowing of water in the beach.

12. A sound wave is a pressure wave; regions of high (compressions) and low pressure (rarefactions) are established as the result of the vibrations of the sound source. These compressions and rarefactions result because sound _____.
- A. Is more dense than air and thus has more inertia, causing the bunching up of sound.
 - B. Waves have a speed that is dependent only upon the properties of the medium.
 - C. Is like all waves; it is able to bend into the regions of space behind obstacles.
 - D. Vibrates longitudinally; the longitudinal movement of air produces pressure fluctuations.
13. They say that noise in space is not possible. Which of the following statements will best support this claim?
- A. Sound cannot travel in space because light isn't present. Light is good medium for sound to travel.
 - B. Asteroids and other space materials inhibit the travel of sound in space.
 - C. Sound needs a medium for it to travel. Space is considered as vacuum, therefore, there no possible medium that can support sound to travel.
 - D. The statement is wrong because sound can freely travel in space.
14. Edward is the new drummer of a band. He is studying the difference between the drums that is going to play. Which of the following is the difference between the bass drum and a snare drum in terms of their sound produced?
- A. The bass drum produces higher frequency compared to snare drum
 - B. The bass drum produces lower frequency compared to snare drum
 - C. The bass drum produces higher amplitude compared to snare drum
 - D. The bass drum produces lower amplitude compared to snare drum
15. Typhoon Yolanda of the Philippines left a great amount of damage and loss lives not only because of its rainfall but also because of the formation of storm surges. Which of the following causes a storm surge in a typhoon?
- A. The low pressure and the high pressure area in the typhoon swirl together resulting to the movement of ocean water
 - B. The eye of the typhoon pushes the water creating waves.
 - C. The force of the wind is transferred to water resulting to the formation of large water waves
 - D. The location of the typhoon affects the formation of the storm surges, the deeper the ocean the larger the storm surge.

16. Storm surges are ocean waves with heights that can reach up to 40 meters and can devastate a whole town in less than a minute. Which of the following conditions can amplify the damage of a storm surge in an area?
- A. When it coincides with typhoon force winds blowing onshore*
 - B. When it coincides with high-tides during bi-monthly spring tides
 - C. When it coincides with the heavy rain fall
 - D. When it arrives at night.
17. Nel is a resident in a coastal area. He informed himself about the possible tragedies that may occur in such place. He saw in the internet about the precautionary measures in tsunamis. Which of the following situations can trigger Nel and other residents in the coastal area to evacuate?
- A. The ocean begins to recede, showing the ocean floor
 - B. An earthquake is felt near a susceptible coastline area
 - C. A tsunami siren is heard
 - D. A giant wall of water is seen moving towards the beach
18. The energy within the tsunami can cause them to _____.
- A. Fly into the air
 - B. Explode
 - C. Travel long distances inland
 - D. Damage the marine life
19. Mang Ricardo was in a large fishing boat on an open sea. While in the boat, an earthquake with a magnitude of 7.0 occurred on the ocean floor. After sometime, a large tsunami hit the shoreline of the island where Mang Ricardo lives. He and his crews were awed in disbelief because they did not see nor notice any formation of tsunami in the open sea. Which of the following statements explains why do people on boats in the open sea do not notice a tsunami approaching?
- A. People on boats will usually mistake the large waves for tidal waves and not recognize them as tsunamis.
 - B. Tsunamis are too small in amplitude in the open ocean and the distance between crests is too large for people on boats to notice their passing.
 - C. Because tsunamis are produced by earthquakes, people on boats are probably still recovering from the initial tremors and thus do not notice a change in the waves.
 - D. The statement isn't true. Tsunami waves are always noticed by people on boats in the open ocean.

20. Tsunamis can wreak havoc on coastal populations and landscapes. The December 26, 2004, tsunami in the Indian Ocean claimed some 150,000 lives and cleared the landscape on millions of acres of oceanfront terrain. Which of the following should you do if you are caught in a tsunami?
- A. Know the warning signs of a tsunami: rapidly rising or falling coastal waters and rumblings of an offshore earthquake.
 - B. Never stay near shore to watch a tsunami come in.
 - C. A tsunami is a series of waves. Do not return to an affected coastal area until authorities say it is safe.
 - D. All of the above

GLOSSARY OF TERMS USED IN THIS LESSON

Amplitude - The measure of the displacement of the wave from its rest position. The higher the amplitude of a wave, the higher its energy.

Crest - The crest is the highest point of a wave. The opposite of the crest is the trough.

Diffraction - Diffraction is when a wave remains in the same medium, but bends around an obstacle.

Electromagnetic Waves - Electromagnetic waves are waves that can travel through a vacuum. They do not need a medium. Light is a type of electromagnetic wave.

Frequency - The frequency of a wave is the number of times per second that a wave cycles. The frequency is the inverse of the period.

Interference - Interference is when one wave comes into contact with another wave.

Longitudinal - A longitudinal wave is a wave where the disturbance travels in the same direction as the wave. Sound waves are longitudinal.

Mechanical Waves - A mechanical wave is a wave that must travel through some sort of matter called a medium. Mechanical waves cannot travel through a vacuum like outer space.

Medium - The medium is the matter that a wave travels through.

Period - The period of a wave is the time between wave crests. It is the inverse of the frequency.

Reflection - Reflection occurs when a wave bounces off a boundary, changing direction but remaining in the same medium.

Refraction - The change in direction and wavelength when a wave moves from one medium to another.

Sound wave - Sound waves are mechanical waves that are caused by a vibration. Sound waves can be heard by our ears.

Speed - The speed of a wave is a measure of how fast the disturbance of the wave is moving. The speed can be dependent on the type of medium that a wave is moving through.

Standing wave - A standing wave is a wave that remains in a constant position.

Transverse - A transverse wave is a wave where the disturbance moves perpendicular to the direction of the wave.

Wave - A wave is a traveling disturbance that moves through space and matter. Waves transfer energy from one place to another, but not matter.

Wavelength - The wavelength of a wave is the distance between two corresponding points on back-to-back cycles of a wave. For example, between two crests of a wave.

Trough - The trough is the lowest part of the wave. The opposite of the trough is the crest.

REFERENCES AND WEBSITE LINKS USED IN THIS LESSON:

Ripple Video

<http://www.youtube.com/watch?v=-DdSGOCCFpE>

Waves and Wavelike Motion

<http://www.physicsclassroom.com/class/waves/Lesson-1/Waves-and-Wavelike-Motion>

Categories of Waves

Source: <http://www.physicsclassroom.com/class/waves/Lesson-1/Categories-of-Waves>

What are Waves (Introduction)

<http://www.absorblearning.com/physics/demo/units/DJFPh063.html#Introduction>

Properties of Waves

<http://www.absorblearning.com/physics/demo/units/DJFPh064.html>

Types of Waves - Video

<http://www.youtube.com/watch?v=yd-G6KYwzvA>

Properties of Waves - Video

<http://www.youtube.com/watch?v=X1OGiWPq5j8>

Online Quiz about Waves and its Characteristics

<http://www.softschools.com/quizzes/science/waves/quiz343.html>

Behavior of Waves – Video

<http://www.youtube.com/watch?v=kIdESF0OwTo>

Reflection, Refraction and Diffraction of Waves

<http://www.physicsclassroom.com/class/waves/Lesson-3/Reflection,-Refraction,-and-Diffraction>

Sound is a Mechanical Wave

<http://www.physicsclassroom.com/class/sound/Lesson-1/Sound-is-a-Mechanical-Wave>

Sound as a Longitudinal Wave

<http://www.physicsclassroom.com/class/sound/Lesson-1/Sound-as-a-Longitudinal-Wave>

Sound is a Pressure Wave

<http://www.physicsclassroom.com/class/sound/Lesson-1/Sound-is-a-Pressure-Wave>

Properties of Sound Waves

http://www.studyphysics.ca/newnotes/20/unit03_mechanicalwaves/chp141516_waves/lesson49.htm

Formation of Water Waves

<https://www.youtube.com/watch?v=HvklXnAAoHA>

The 2004 Boxing Day Tsunami

<https://www.youtube.com/watch?v=RDOuwMj7Xzo>

Tsunami – Video

<https://www.youtube.com/watch?v=SlwZzbGh7Cw>

Formation of Tsunamis

<http://academic.evergreen.edu/g/grossmaz/springle/>

Precautionary Measure about Tsunamis

<http://news.nationalgeographic.com/news/2007/04/070402-tsunami.html>

Formation of Storm Surges

http://www.stormsurge.noaa.gov/overview_formation.html

Effects of Storm Surges

<http://www.bom.gov.au/cyclone/about/stormsurge.shtml>