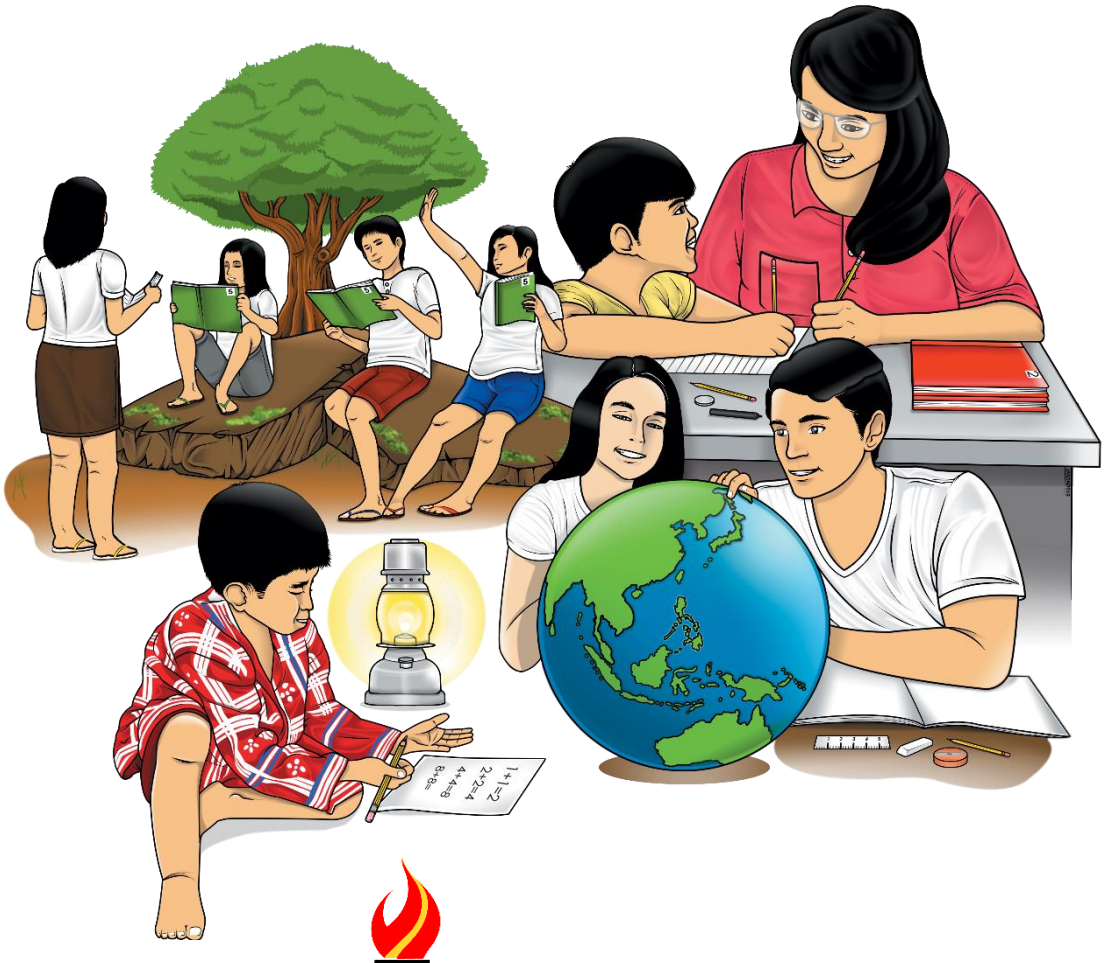
7

DepED
DEPARTMENT OF EDUCATION

Science

Quarter 3 – Module 3

The Waves



ALTERNATIVE DELIVERY MODE
ADM

Science– Grade 7
Alternative Delivery Mode
Quarter 3 – Module 3: The Waves
First Edition, 2020

Published by the Department of Education
Secretary: Leonor Magtolis Briones
Undersecretary: Diosdado M. San Antonio

Development Team of the Module

Writer: Wilfredo D. Bartolo, Jr., Carmelyn L.Porras

Editors: Cynthia S. Bustillo, Miraflor O. Albios, Lenie G. Forro, Rian S. Linao

Reviewers: Mary Joy D. Bautista, Agabai S. Kandalayang, Marivic D. Devibar, Maria Jane N. Agrave

Layout Artist: Glen D. Napoles, Analyn J. Madera, and Allan T. Basubas

Management Team: Allan G. Farnazo
Isagani S. Dela Cruz
Gilbert B. Barrera
Arturo D. Tingson, Jr.
Peter Van C. Ang-ug
Elpidio B. Daquipil
Juvy B. Nitura
Lenie G. Forro

Printed in the Philippines by

Department of Education –SOCCSKSARGEN

Office Address: Regional Center, Brgy. Carpenter Hill, City of Koronadal
Telefax: (083) 2281893
E-mail Address: region12@deped.gov.ph

7

Science

Quarter 3 – Module 3

The Waves

DepED

DEPARTMENT OF EDUCATION

Introductory Message

This Self-Learning Module (SLM) is prepared so that you, our dear learners, can continue your studies and learn while at home. Activities, questions, directions, exercises, and discussions are carefully stated for you to understand each lesson.

Each SLM is composed of different parts. Each part shall guide you step-by-step as you discover and understand the lesson prepared for you.

Pre-tests are provided to measure your prior knowledge on lessons in each SLM. This will tell you if you need to proceed on completing this module or if you need to ask your facilitator or your teacher's assistance for better understanding of the lesson. At the end of each module, you need to answer the post-test to self-check your learning. Answer keys are provided for each activity and test. We trust that you will be honest in using these.

In addition to the material in the main text, Notes to the Teacher are also provided to our facilitators and parents for strategies and reminders on how they can best help you on your home-based learning.

Please use this module with care. Do not put unnecessary marks on any part of this SLM. Use a separate sheet of paper in answering the exercises and tests. And read the instructions carefully before performing each task.

If you have any questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

Thank you.

What I Need to Know

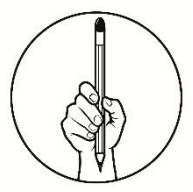
Hello! How are you? You should be able to realize that understanding many natural phenomena, entails understanding the concept of waves? For instance, the occurrence of earthquakes, in engineering, skyscrapers and bridges and in how radios and televisions work. In order to understand all of these, concepts about the origin, nature and propagation of waves have to be examined.

Most Essential Learning Competency:

Infer that waves carry energy. S7LT-IIIc-4

After going through this module, you are expected to:

- classify waves as either transverse or longitudinal and mechanical or electromagnetic;
- draw and identify parts of transverse and longitudinal waves, and
- relate the importance of understanding the concept of waves to real life situations.



What I Know

Directions: Read and understand the questions carefully. Choose the letter of the **BEST** answer and write your answer on a separate sheet of paper.

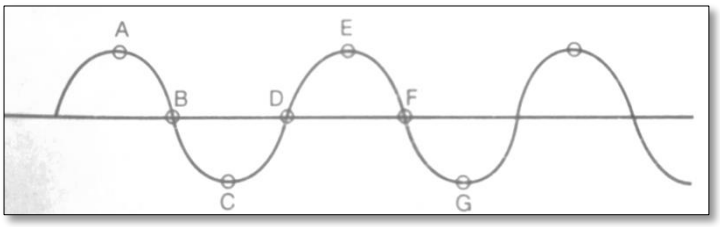
1. Which of the following is **not** an example of a mechanical wave?
   A. Light
   B. Sound waves
   C. Seismic waves
   D. P - waves
2. Which of the following statements about the anatomy of transverse waves is correct?

I. The distance from one crest to the next crest is the amplitude of transverse wave. II. The lowest point on the transverse wave is trough. III. The wavelength of a transverse wave is a distance from one crest to the next crest. IV. The highest point on the transverse wave is crest.

   A. I, II, III, IV
   B. II, III, IV only
   C. I, III, IV only
   D. I, II, III only

3. Does the sound intensity decrease as it spreads outward in all directions from the source?
   A. The intensity of sound does not change as it moves outward from the source.
   B. The intensity of sound decreases as it moves outward from the source.
   C. The intensity of sound increases as it moves outward from the source.
   D. The intensity of sound alternately increases and decreases as it moves outward from the source.
4. What type of wave does **NOT** need a medium for it to propagate?
   A. Electromagnetic waves
   B. Mechanical waves
   C. Surface waves
   D. Ocean waves
5. Marky is doing an experiment. He throws a piece of stone in a pond. Was he able to create waves?
   A. No, waves were created when the stone touches water.
   B. Yes, he was able to create depressions on the water.
   C. No, the stone floats on the water.
   D. Yes, he observes that when the stone touches the water, circular ripples are formed.
6. In which general type of wave do the particles move perpendicular to the direction of the wave motion?
   A. Longitudinal waves
   B. Transverse wave
   C. Mechanical wave
   D. Electromagnetic wave
7. Which of the following statements DOES NOT correctly describe~~s~~ a wave?
   A. The highest point on a transverse wave is the trough.
   B. Waves carry and transfer energy.
   C. Wave is a propagation though a medium or space.
   D. Waves have characteristics such as amplitude and wavelength.
8. What refers to the number of waves that passes through a given point at a particular time?
   A. Amplitude
   B. Frequency
   C. Period
   D. Wavelength
9. Which of the following statements incorrectly describes electromagnetic wave?
   A. Electromagnetic wave is a type of wave that can transmit energy even without any medium.
   B. Electromagnetic wave is a type of wave that transmits energy through a medium.
   C. When you use radio or watch movie on your LED television you are using electromagnetic waves.
   D. The waves that cook the popcorn in the microwave oven are electromagnetic waves.

For items 10 - 12



(Photographed by: Carmelyn L. Porras)

10. The wavelength is the horizontal distance between points _____
    A. A and B
    B. A and D
    C. A and E
    D. B and D

11. Which of the following points is a crest?
    A. A
    B. B
    C. C
    D. D

12. Which of the following points is a trough?
    A. A
    B. B
    C. C
    D. D

13. Which of the following is NOT an example of a wave?
    A. Microwave
    B. Radio wave
    C. Visible light
    D. Wavelength

14. The following statements correctly describes mechanical wave, **EXCEPT**
    A. Mechanical waves do~~es~~ not propagate through a medium.
    B. Mechanical waves may be transverse or longitudinal.
    C. Mechanical wave needs a medium for it to propagate.
    D. Sound is an example of a mechanical wave.

15. Which of the following terms generally refer to a disturbance propagated in space or through a medium?
    A. Heat energy
    B. Force
    C. Frequency
    D. Wave

Lesson 1

Types of Waves

What's In

There you go! In our previous lesson, we learned that a wave is a periodic disturbance that moves away from a source and carries energy with it. We can add that waves are produced through vibrations. Things that vibrate such as waving of our hands to signify friendship, strumming of guitar to produce acoustic sound and back and forth motion of the earth's crust that result to earthquakes are all examples of waves. Finally, to understand how skyscrapers, bridges, seismograph, television and radio work, concepts about the types, nature and propagation of waves have to be studied through this module. Shall we now find out?

What's New

Hello there! I need your help. I want to find out the types, nature and anatomy of waves. Can you help me? All you have to do is read, understand and perform the different activities below. Are you ready? Let's start!

Activity 1 Let's Make Waves!

1. Observe what is presented in the photograph. Sketch the waves as seen from above the water basin. Label the source of the disturbance.

``

Photographed by: Carmelyn L Porras

2. Make a paper boat. Place it in the middle of the basin. Tap the water that surrounds the paper boat then observe. Answer the guide questions below.

   a. Do the waves set the paper boat into motion? What is required to set an object into motion?
   b. If you exert more force in creating periodic waves by tapping the surface with greater strength, how does this affect the movement of the paper boat?

3. Sketch the water waves as seen them from above the basin. One wavelength should be labeled in the drawing.

4. Tap the water rapidly to increase the rate of the vibration. What happens to the wavelength of the waves? Sketch the water waves as seen from the top of the basin.

5. Discuss the steps in determining the speed of a wave. Please refer to the performance rubric below.

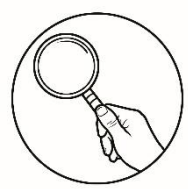
Criteria	10pts.	7pts.	5pts.
Accuracy of Content	The facts and explanations are clearly, concise and presented well.	The facts and explanation are clear with supporting documents.	The facts and explanation are lacking.
Presentation of output	The output is original and presented in unique and interesting way.	The presentation shows an attempt of originality.	The presentation is copied.
Creativity and cleanliness	The work is very creative and clean.	The work is somewhat creative but clean.	The work is not creatively done and not clean.

Points to Remember:

1. Waves can be typified according to the direction of motion of the vibrating particles with respect to the direction in which the waves travel.
   a. Waves in a rope may be classified as transverse waves because the individual segments of the rope vibrate perpendicular to the direction in which the waves travel.
   b. When each portion of a coil spring is alternatively compressed and extended, longitudinal waves are produced.
   c. Waves on the surface of a body of water are a combination of transverse and longitudinal wave motion. Each water molecule moves in a circular pattern as the waves pass by.

2. Waves carry energy because waves can set other objects into motion

3. When wave pass by, particles vibrate alternately to transport the energy of the waves.



What is It

Waves can be typified according to the direction of motion of the vibrating particles with respect to the direction in which the waves travel. The types of waves according to the direction of motion of the vibrating particles with respect to the direction in which the waves travel are transverse, longitudinal and surface waves.

Types of waves

1. **Transverse waves** vibrate perpendicularly to the direction in which the waves travel. This wave exhibits up and down motion.
2. **Longitudinal waves** vibrate parallel or back and forth to the direction in which the waves travel.
3. **Surface waves** are combination of transverse and longitudinal waves. These move in a circular pattern as the waves pass by.

The types of waves according to propagation

1. **Mechanical waves** propagate only through solid, liquid and gas medium. Mechanical waves may be transverse, longitudinal or surface. Some physical medium is being disturbed for the wave to propagate. A wave travelling on a string would not exist without the string. With mechanical waves, what we interpret as a wave corresponds to the propagation of a disturbance through a medium.
2. **Electromagnetic waves** do not need medium to propagate. Radio waves, ultraviolet, microwaves, x-rays, infrared, and gamma rays are examples of electromagnetic waves. The sun is an important source of electromagnetic radiation for the earth. Energy from the sun is important to sustain the life of the earth. Another example of the electromagnetic waves from the sun are ultraviolet (UV) waves, which is the main cause of sunburn. Sunscreen lotions are transparent to the visible light but absorb most of UV light. The higher a sunscreen's solar protection factor (SPF), the greater the percentage of UV light absorbed.

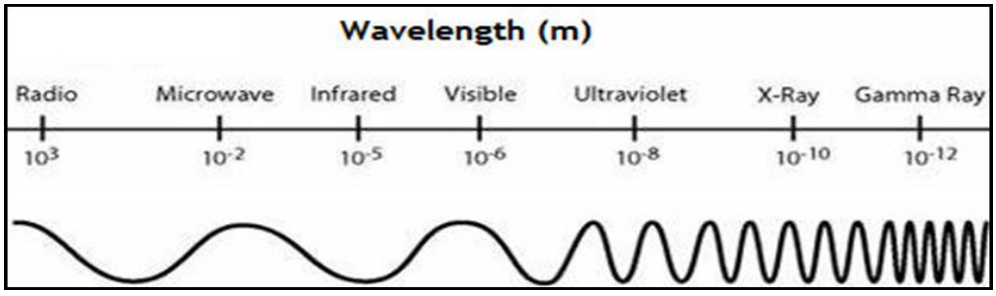


Figure shows the wavelength of electromagnetic waves sample
Illustrated by: Braxmeier, H. (Source www.pixabayclipart.com)

The Anatomy and Nature of Transverse Waves

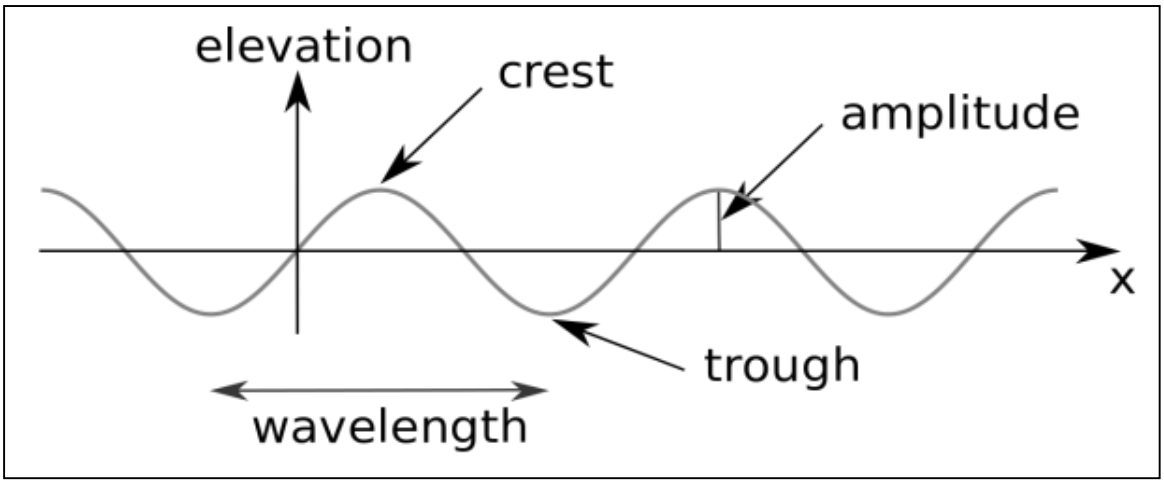
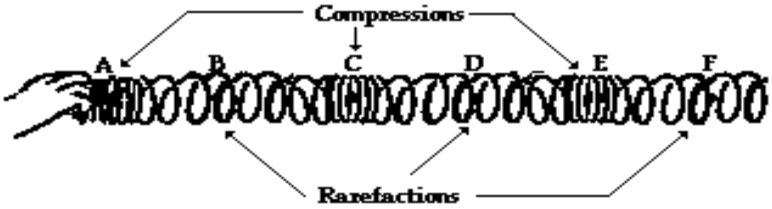


Figure shows the anatomy and nature of a transverse wave

Transverse Wave (Source: Vedran, B. www.free.svg.org.com)

The nature of transverse waves can be described through its terms, quantities and anatomy. The **crest** and **trough** refer to the highest point and lowest point of a wave pattern, respectively. The **amplitude** of a wave is the maximum displacement of a particle of the medium on either side of its normal position when the wave passes. The **frequency** (measured in Hertz)of periodic waves is the number of waves that pass a particular point for every unit of time such as one second while the **wavelength**(measured in meters) is the distance between adjacent crests or troughs. The **period** is the time (measured in seconds) required for one complete wave to pass a particular point. The **speed** of the wave refers to the distance the wave travels per unit time. It is related to the frequency of the wave and wavelength through the following equation: wave speed= frequency x wavelength

The Anatomy and Nature of Longitudinal Waves



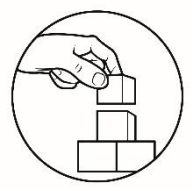
Longitudinal Wave (Source: Lessig, L. www. creativecommons.com)

A **longitudinal wave** is a wave in which the particles of the medium are displaced in a direction parallel to the direction of energy transport. A longitudinal wave can be created in a slinky if the slinky is stretched out horizontally and the end coil is vibrated back-and-forth in a horizontal direction. Longitudinal waves show areas of compression and rarefaction. Compressions are regions of high pressure due to particles being close together (points A, C, E). Rarefactions are regions of low pressure due to particles being spread further apart (points B, D, F). The crest is the top of the wave. The trough is at the bottom of the wave. The wavelength is the length of the wave from compression to compression. The amplitude of a wave is the highest amount of vibration that the medium gives from the rest position.

Remember this:

1. Wave speed, wavelength and frequency are related by the equation: Wave speed = frequency x wavelength. The frequency of a wave is inversely proportional to the wavelength. When a wave has a high frequency, it has a short wavelength and when a wave has low frequency, it has a long wavelength.

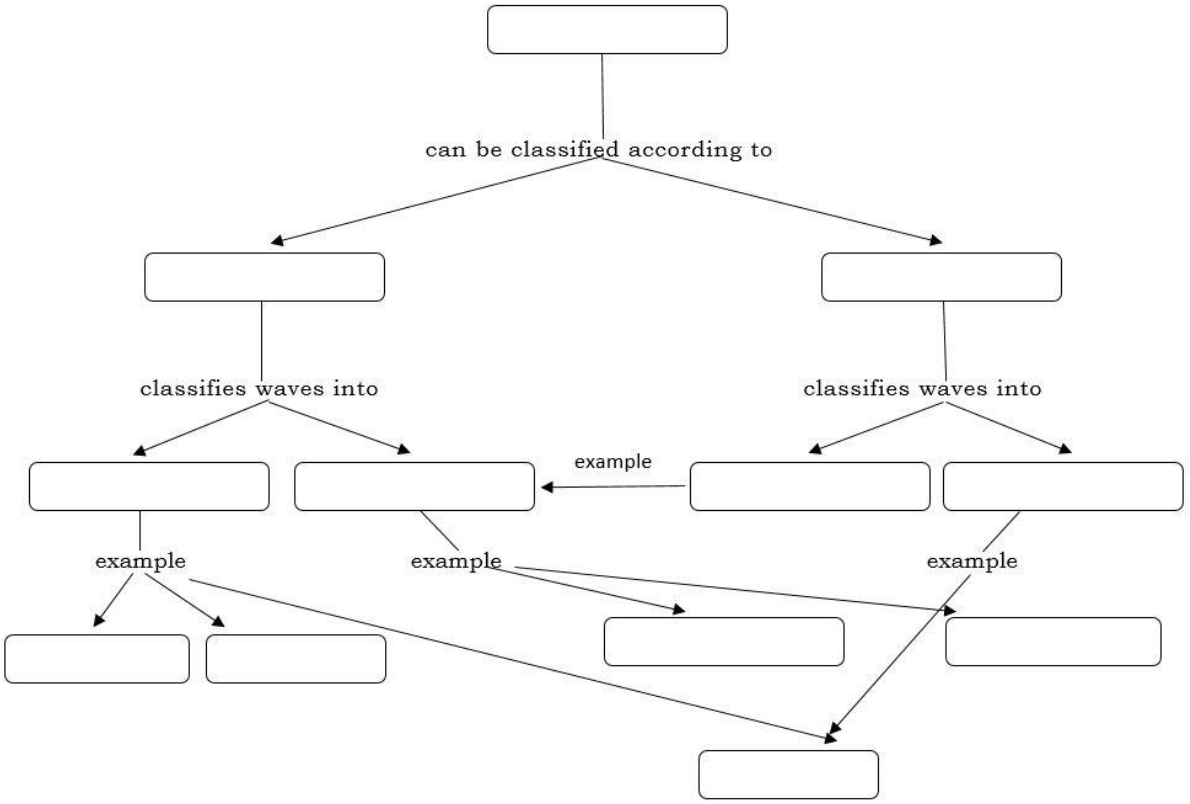
2. Suppose you observed an anchored boat to rise and fall once every 4.0 seconds as waves whose crests are 25 meters apart pass by it.
   a. What is the frequency of the observed waves? The frequency of the waves is 0.25 Hz. Frequency = 1/period = 1/4.0 seconds = 0.25 Hz
   b. What is the speed of the waves? The speed of the waves is 6.3 m/s. Wave speed = (frequency)*(wavelength) = (0.25 Hz) x (25 m) = 6.3 m/s



What's More

Directions: Use a concept map to classify and group the types of waves. Write your answer on a separate sheet of paper.

waves	mechanical waves	relative motion of particles	surface waves
infrared rays	electromagnetic waves	longitudinal waves	sound
gamma rays	earthquake	medium of propagation	transverse waves



Directions: Find the words that are hidden in the grid. The words may be in horizontal, vertical or diagonal in directions. Copy and write your answers on a separate sheet of paper.

crest	amplitude	trough
wavelength	frequency	period

C	R	E	S	T	L	F	T	I	M	E	E	M	T
I	T	O	A	D	F	R	N	I	L	R	C	A	R
P	H	S	S	T	O	E	E	Y	A	E	S	N	O
H	E	P	B	I	S	Q	O	I	O	Q	A	O	U
E	T	R	S	T	P	U	E	L	E	N	G	T	G
S	N	E	I	A	E	E	S	A	O	S	T	R	H
P	S	R	O	O	E	N	S	Y	S	T	E	M	M
E	T	E	R	C	D	C	E	E	C	O	I	S	Y
E	U	B	H	O	B	Y	R	B	I	O	T	I	A
D	H	W	A	V	E	L	E	N	G	T	H	N	E
O	A	I	K	O	O	E	B	I	O	T	I	C	R
A	M	P	L	I	T	U	D	E	I	C	H	O	S

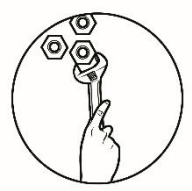
What I Have Learned

Directions: Read the paragraph carefully and identify the correct words on the box that fit in the given sentences in the selection below. Write your answers on a separate sheet of paper.

damage	disturbance	direction	transverse
electricity	production	longitudinal	perpendicular
energy	propagation	parallel	mechanical
surface	matter	medium	formation
electromagnetic	crust	crest	magnitude
anatomy	amplitude	wavelength	speed

Wave is a periodic (1) _____ that moves away from a source which carries (2) _____ with it. Waves can be typified according to the (3) _____ of motion of the vibrating particles with respect to the direction in which the waves travel and according to (4) _____ .
(5) _____waves vibrate perpendicularly to the direction in which the waves travel. This wave exhibits up and down motion. Longitudinal waves vibrate (6) _____ or back and forth to the direction in which the waves travel. (7) _____ waves are combination of transverse and longitudinal waves. These move in a circular pattern as the waves pass by. (8) _____ waves need solid, liquid and gas medium to propagate or travel. Transverse, mechanical and surface waves are examples of mechanical waves. Electromagnetic waves do not need (9) _____ to propagate. Radio waves, ultraviolet, infrared, and gamma rays are examples of (10) _____ waves. The nature of waves can be described through its terms, quantities and (11) _____.

The (12) _____and trough refer to the highest point and lowest point of a wave pattern, respectively. The (13) _____ of a transverse wave is the maximum displacement of a particle of the medium on either side of its normal position when the wave passes. The frequency of periodic waves is the number of waves that pass a particular point for every one second while the (14) _____ is the distance between adjacent crests or troughs. 4. The period is the time required for one complete wave to pass a particular point. The (15) _____of the wave refers to the distance the wave travels per unit time. It is related to the frequency of the wave and wavelength through the following equation: wave speed= frequency x wavelength



What I Can Do

Directions: Draw and label the anatomy of a transverse and a longitudinal wave on a separate sheet of paper.

Performance Rubrics

Criteria	10 pts.	7 pts.	5 pts.
A. Drawing Technique and Understanding of Concepts	Drawing shows good technique and understanding of concept is clear.	Drawing shows some technique and understanding of concept is not so clear.	Drawing lacks technique and understanding of concept is vague.
B. Craftsmanship	Drawing is neat and shows very little evidence of marks, rips, tears, or folds. There are erasure lines.	Drawing is somewhat messy and shows marks rips, tears, or folds. Some erasure lines are evident	Drawing is messy and shows marks rips, tears, or folds. Many erasure lines are evident
C. Creativity	Art work reflects originality.	Art work shows some evidence of originality.	Art work shows little or no evidence of original thought.

Assessment

Directions: Read and understand the questions carefully. Write your answer on a separate sheet of paper.

1. Which of the following correctly describes a wave?
   A. It can set an object into motion
   B. It moves through materials only.
   C. It transmits weaker force
   D. It is static

2. The following are electromagnetic waves, **EXCEPT**
   A. Infrared
   B. Gamma rays
   C. Sound
   D. X-rays

3. Which of the following statements correctly describes a wave?

I. It does not carry energy.
II. It is a periodic disturbance.
III. It moves away from a source.
IV. It can set an object into motion.

   A. I,II,III,IV
   B. I,II,III only
   C. II,III,IV only
   D. I,III,IV only

4. What type of wave needs a medium to propagate?
   A. Electromagnetic waves
   B. Mechanical waves
   C. Microwaves
   D. Ultraviolet

5. Suppose you observed an anchored boat rise and fall once every 8.0 seconds as waves whose crests are 25 meters apart pass by it. What is the frequency of the observed waves?
   A. 0.100 Hz
   B. 0.105Hz
   C. 0.125Hz
   D. 1.000 Hz

6. Which type of wave is characterized by the parallel motion of the particles in the wave to the wave propagation?
   A. Electromagnetic
   B. Longitudinal
   C. Mechanical
   D. Transverse

7. Earthquake(seismic)waves are felt through the grounds. Are these waves electromagnetic in nature?
   A. Yes, because these need medium in order to propagate.
   B. No, because these do not need medium to propagate.
   C. No, because these are mechanical waves.
   D. Yes, because this carry energy.

8. Which of the following statements correctly describes a mechanical wave?

I. Mechanical wave propagates through a medium II. Mechanical waves may be transverse or longitudinal. III. Mechanical wave needs material medium such as solid, liquid or gas to transport its energy from one location to another. IV. Sound is a mechanical wave.

   A. I,II,III,IV
   B. I,II,III only
   C. II,III,IV only
   D. I,II,IV only

9. What refers to the number of waves that passes through a given point at a particular time?
   A. Amplitude
   B. Frequency
   C. Period
   D. Wavelength

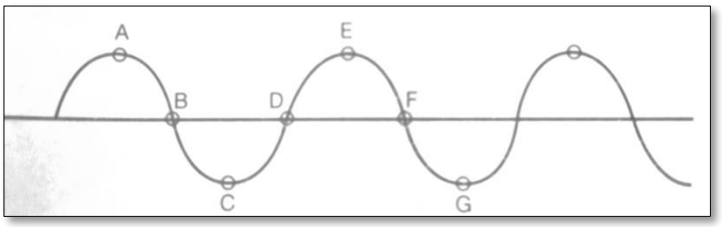
10. The following are examples of mechanical waves, **EXCEPT**
   A. Longitudinal
   B. Surface
   C. Sound
   D. X – ray

11. Marky is doing an experiment. He throws a piece of stone in a pond. Does he observe a wave?
   A. Yes, he observes that when stone touches water it moves back and forth.
   B. Yes, he observes that when the stone touches the water, circular ripples are formed.
   C. No, he observed that when stone hits water it does not produce wave.
   D. No, he does not observe wave when the stone touches water.

12. What type of wave moves in circular motion relative to the direction of the wave motion?
   A. Electromagnetic
   B. Mechanical
   C. Surface
   D. Transverse

13. What helps the sound waves travel through air?
    A. Atoms of air
    B. Electrons of air
    C. Molecules of air
    D. Protons of air

For questions number 14 – 15, refer to the figure below.



Photographed by: Carmelyn L.Porras

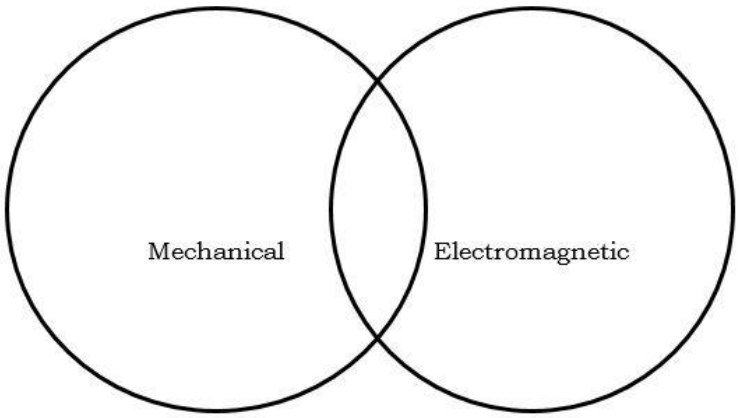
14. The points at A to E and C to Gare referred to as
    A. Amplitude
    B. Period
    C. Trough
    D. Wavelength

15. Which of the following points on the transverse wave are moving in the same direction?
    A. A and C
    B. A and E
    C. C and F
    D. B and G

Additional Activities

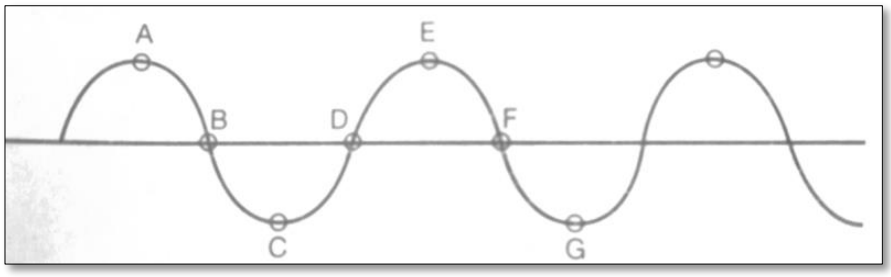
Directions: Fill out the Venn Diagram below with similarities and differences between mechanical and electromagnetic waves. Use the labelled circles for the terms that relate to mechanical and electromagnetic waves individually. Identify the terms that relate to both the two classifications of waves on the overlap. Copy and write your answer on a separate sheet of paper.

Types of waves
Needs medium to propagate
Sound wave
Ultraviolet ray
Periodic disturbance
Does not need medium to propagate



Directions: Study the figure of a wave below. Label the parts of the wave using the notations below. Copy and write your answer on a separate sheet of paper.

Notations	Parts
Point A	
Point G	
Length DE	
Length CG	



Photographed by: Carmelyn L.Porras

Answer Key

What I Know

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

Assessment

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

References

Books

Asuncion, Alvie J., Ph D. *K to 12 Science Grade 7 Learners Material.* First. Pasig City: Bureau of Learning Resources (Deped - BLR), 2017.

Department of Education Strand Curriculum. *Most Essential Learning Competency.* Pasig City: Deped BLR, 2020.

K to 12 Science Curriculum Guide. Pasig City: Department of Education BLR, 2018.

Learning Resource Portal *BEAM IV Unit 2 Waves. 3rd Edition* Quezon City: Bureau of Learning Resources, 2014.

Websites

Creative Commons March 5, 2019. ttps://creativecommons.org/publicdomain (accessed July 15, 2020).

Pixabay. September 10, 2010. http://pixabayclipart.com (accessed July 7, 2020).

2020. http://publicdomainvectors.com (accessed July 1, 2020).

Vedran, Boris Rob S. September 10, 2019. http://free.svg.org.com (accessed July 21, 2020).

For inquiries or feedback, please write or call:

Department of Education - Bureau of Learning Resources (DepEd-BLR)

Ground Floor, Bonifacio Bldg., DepEd Complex
Meralco Avenue, Pasig City, Philippines 1600

Telefax: (632) 8634-1072; 8634-1054; 8631-4985

Email Address: blr.lrqad@deped.gov.ph *blr.lrpd@deped.gov.ph