General Physics SHS Quarter 2 Module 5

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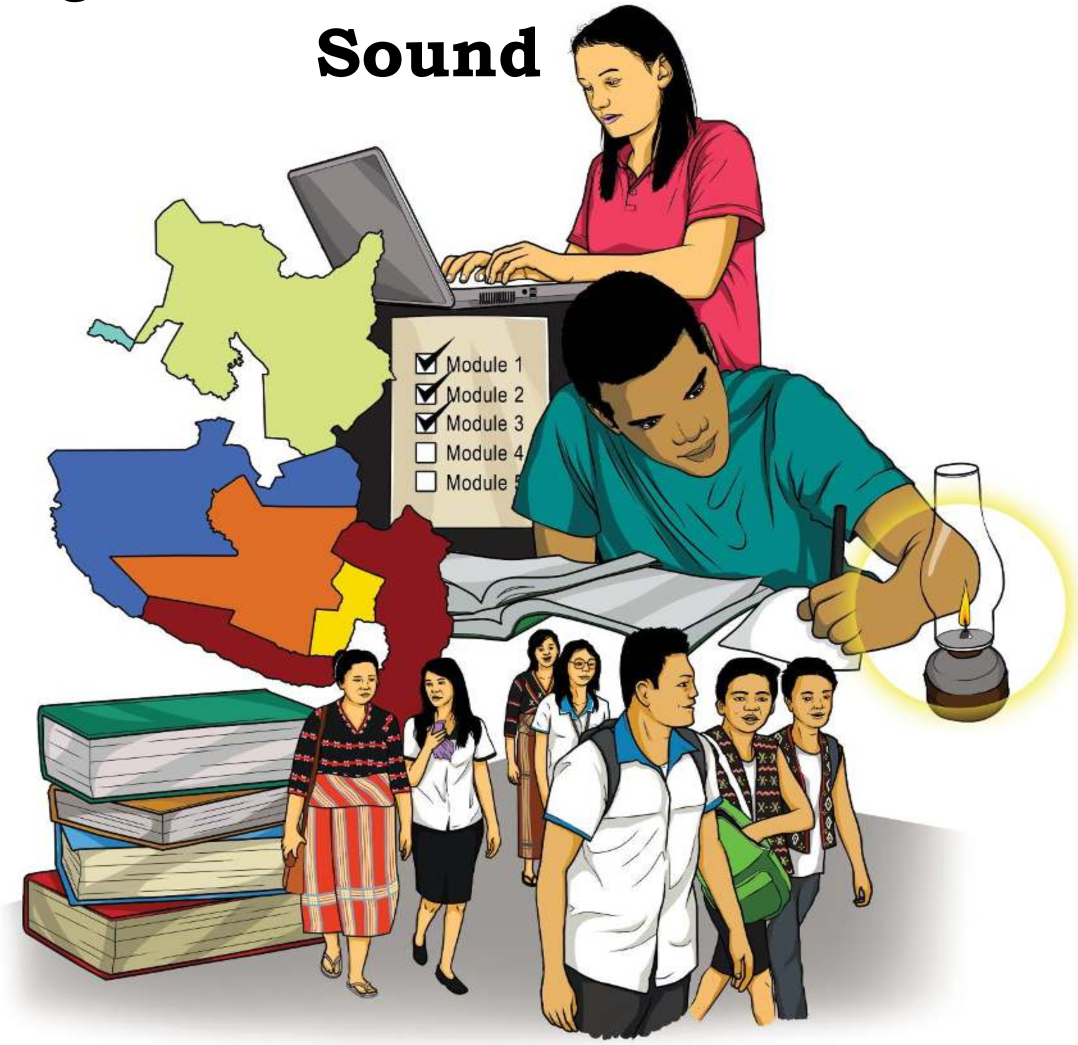
General Physics 1

Quarter 2 – Module 5: Sound



SELF-LEARNING MODULE

DEPARTMENT OF EDUCATION - SOCCSKSARGEN

General Physics I
Self-Learning Module (SLM)
Quarter 2 – Module 5: SOUNDS
First Edition, 2020

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General Physics I

Quarter 2 – Module 5:

Sounds

Introductory Message

For the facilitator:

Welcome to the **General Physics I Self-Learning Module** (SLM) on **Sounds.**

This module was collaboratively designed, developed and reviewed by educators both from public and private institutions to assist you, the teacher or facilitator in helping the learners meet the standards set by the K to 12 Curriculum while overcoming their personal, social, and economic constraints in schooling.

This learning resource hopes to engage the learners into guided and independent learning activities at their own pace and time. Furthermore, this also aims to help learners acquire the needed 21st century skills while taking into consideration their needs and circumstances.

In addition to the material in the main text, you will also see this box in the body of the module:

Notes to the Teacher

This contains helpful tips or strategies that will help you in guiding the learners.

As a facilitator you are expected to orient the learners on how to use this module. You also need to keep track of the learners' progress while allowing them to manage their own learning. Furthermore, you are expected to encourage and assist the learners as they do the tasks included in the module.

For the learner:

Welcome to the **General Physics I**- Self-Learning Module (SLM) on **Sounds.**

The hand is one of the most symbolized part of the human body. It is often used to depict skill, action and purpose. Through our hands we may learn, create and accomplish. Hence, the hand in this learning resource signifies that you as a learner is capable and empowered to successfully achieve the relevant competencies and skills at your own pace and time. Your academic success lies in your own hands!

This module was designed to provide you with fun and meaningful opportunities for guided and independent learning at your own pacing. You will be enabled to process the contents of the learning resource while being an active learner.

This module has the following parts and corresponding icons:

What I Need to Know	This will give you an idea of the skills or competencies you are expected to learn in the module.
What I Know	This part includes an activity that aims to check what you already know about the lesson to take. If you get all the answers correct (100%), you may decide to skip this module.
What's In	This is a brief drill or review to help you link the current lesson with the previous one.
What's New	In this portion, the new lesson will be introduced to you in various ways such as a story, a song, a poem, a problem opener, an activity or a situation.
What is It	This section provides a brief discussion of the lesson. This aims to help you discover and understand new concepts and skills.
What's More	This comprises activities for independent practice to solidify your understanding and skills of the topic. You may check the answers to the exercises using the Answer Key at the end of the module.
What I Have Learned	This includes questions or blank sentence/paragraph to be filled in to process what you learned from the lesson.
What I Can Do	This section provides an activity which will help you transfer your new knowledge or skill into real life situations or concerns.

Assessment	This is a task which aims to evaluate your level of mastery in achieving the learning competency.
Additional Activities	In this portion, another activity will be given to you to enrich your knowledge or skill of the lesson learned. This also tends retention of learned concepts.
Answer Key	This contains answers to all activities in the module.

At the end of this module you will also find:

References	This is a list of all sources used in developing this module.

The following are some reminders in using this module:

1. Use the module with care. Do not put unnecessary mark/s on any part of the module. Use a separate sheet of paper in answering the exercises.
2. Don't forget to answer *What I Know* before moving on to the other activities included in the module.
3. Read the instruction carefully before doing each task.
4. Observe honesty and integrity in doing the tasks and checking your answers.
5. Finish the task at hand before proceeding to the next.
6. Return this module to your teacher/facilitator once you are through with it.

If you encounter any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator. Always bear in mind that you are not alone.

We hope that through this material, you will experience meaningful learning and gain deep understanding of the relevant competencies. You can do i

What I Need to Know

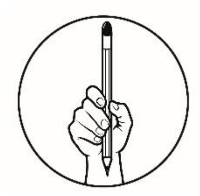
This module was designed and written with you in mind. It is here to help you master the concept of sounds. The scope of this module permits it to be used in many different learning situations. The language used recognizes the diverse vocabulary level of students. The lessons are arranged to follow the standard sequence of the course. But the order in which you read them can be changed to correspond with the textbook you are now using.

The module is divided into four lessons, namely:

- Lesson 1: Interference and Beats
- Lesson 2: Standing Waves and Doppler Effect

After going through this module, you are expected to:

1. Describe qualitatively and quantitatively the superposition of waves;
2. Apply the condition for standing waves on a string; and
3. Relate the frequency (source dependent) and wavelength of sound with the motion of the source and the listener.



What I Know

Choose the best answer. Write the letter of your choice on a separate sheet of paper.

1. What waves are characterized by the vibrations that move perpendicular to the direction of the wave?
   a. electromagnetic waves
   b. transverse waves
   c. light waves
   d. medium

2. What is interference?
   a. It occurs when two or more waves overlap and combine.
   b. It occurs when two or more waves combine and neutralize each other.
   c. It happens when one wave travels alone.
   d. None of these

3. What will happen when a compression interferes with another compression?
   a. They combine to create a larger compression.
   b. They combine to create a rarefaction.
   c. They counteract and diminish.
   d. None of the above.

4. What is frequency?
   a. The time interval between two consecutive waves.
   b. The number of waves or cycles generated per second.
   c. The maximum displacement of a wave from its equilibrium position.
   d. The distance between two identical positions on two consecutive waves.

5. Which of the following statements is TRUE when two waves temporarily interfere with each other then resume their course of movement?
   a. Both waves counteracted and cease to exist.
   b. They take on and keep a new amplitude based on the result of the interference until the end of the movement.
   c. They are not affected by the interference and maintain their original amplitude throughout the movement.
   d. They are temporarily affected by the interference, created new amplitude but resume on their original amplitude until the end of the movement.

6. Which of the following statements best describes “beats”?
   a. The regular pulsing of loudness of a sound which is heard when 2 sources produce sounds of the same frequency.
   b. The regular pulsing of a pitch of a sound which heard when 2 sources produce sounds of slightly different frequency
   c. The regular pulsing of of loudness of a sound which is heard when 2 sources produce sounds of slightly different frequency.
   d. The regular pulsing of a sound giving a characteristic tone/ timbre which is heard when two sources produce sounds of slightly different frequency.

7. What is the beat frequency if a 400 Hz and a 396 Hz sounds are heard by Naz?
   a. 1 Hz b. 2 Hz c. 3 Hz d. 4 Hz

8. What causes sound when you pluck the string of a guitar?
   a. metal on guitar
   b. wood of guitar
   c. vibrations of string
   d. none of these

9. A guitar string has length of .50 m and produces a wave speed of 565 m/s along it. What is the frequency of the 3rd harmonic?
   a. 93.2 Hz b. 282.5 Hz c. 1130 Hz d. 1712 Hz

10. Consider a 90-cm long guitar string that has a fundamental frequency (1st harmonic) of 400 Hz.
   a. 222.2 Hz b. 444.4 Hz c. 666.2 Hz d. 3600 Hz

Lesson 1 Interference and Beats

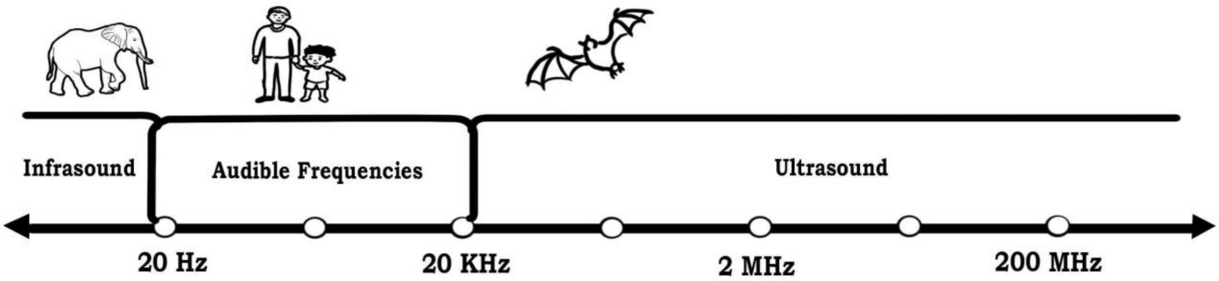
Learning Objective:

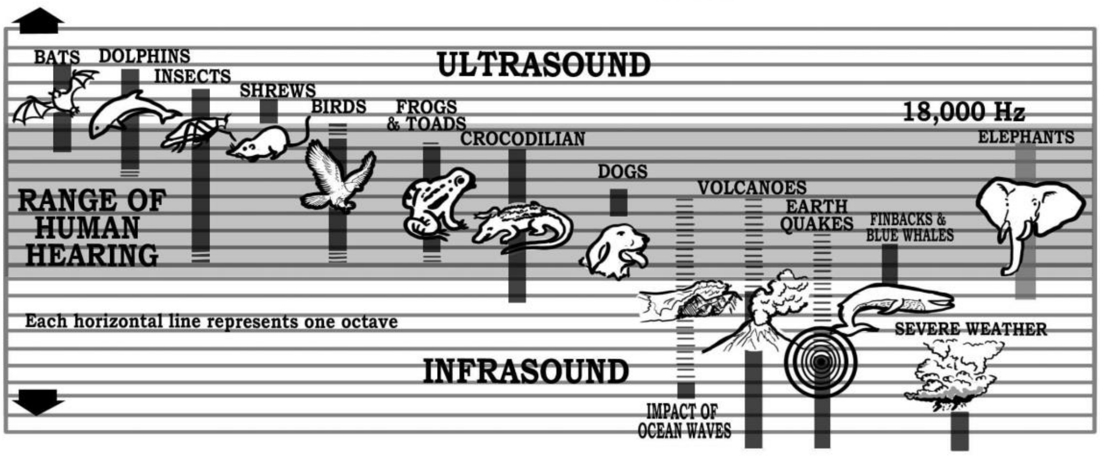
1. Describe qualitatively and quantitatively the superposition of waves.

What's In

Activity 1.1. IDENTIFY ME…

1. What animals produce ultrasound?
2. What animals produce audible sound?
3. What animals and events produce infrasonic sounds?
4. At what range of frequencies are considered audible frequencies?
5. What probably will happen to your ears if you are always exposed to frequencies beyond 200MHz?





What's New

Activity 1.2. COMPLETE ME…

Identify some string and wind instruments that start with the letters in the word SOUND. The first one is done for you.

S- Sanduku, Sanxian, Sarangi, Sarod, Selingut

O-

U-

N-

D-

What is It

SOUND WAVES

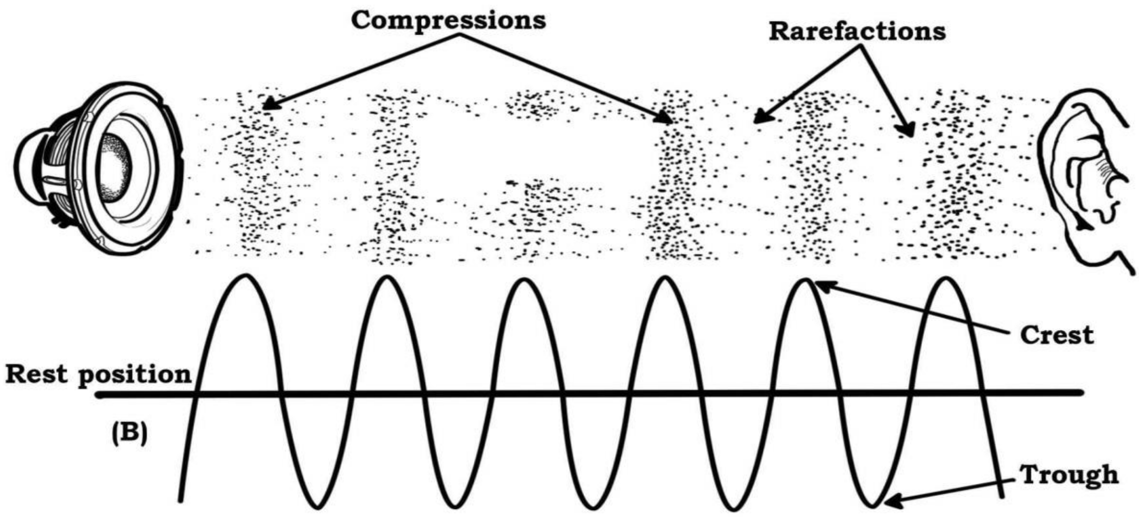
Sound waves are longitudinal mechanical waves that propagate through gases, liquids, and solids. Most familiar is sound in air. The wave disturbance comprises a small change in air pressure and density accompanied by a back-and-forth motion of the air. The simplest sound waves are sinusoidal waves, which have definite frequency, amplitude, and wavelength. Sound waves usually out in all directions from the source of with an amplitude that on the direction and distance from the source.

CHARACTERISTICS OF SOUND WAVES

The general motion of elements of air near a vibrating object is back and forth between regions of compression and rarefaction. This back-and- forth motion of elements of the medium in the direction of the disturbance is characteristic of a longitudinal wave. The motion of the elements of the medium in a longitudinal sound wave is back and forth along the direction in which the wave travels. By contrast, in a transverse wave, the vibrations of the elements of the medium are at right angles to the direction of travel of the wave.

GRAPHING A SOUND WAVE

Sound is a pressure wave which is created by a vibrating object. This vibrations set particles in the surrounding medium (typical air) in vibrational motion, thus transporting energy through the medium. Since the particles are moving in parallel direction to the wave movement, the sound wave is referred to as a longitudinal wave. The result of longitudinal waves is the creation of compressions and rarefactions within the air. The alternating configuration of C and R of particles is described by the graph of a sine wave (C~crests, R~troughs). The speed of a sound pressure wave in air is 331.5+0.6Tc m/s, Tc temperature in Celsius. The particles do not move down the way with the wave but oscillate back and forth about their individual equilibrium position. The sinusoidal variation of pressure pressure with distance distance is a useful way to represent a sound wave graphically.



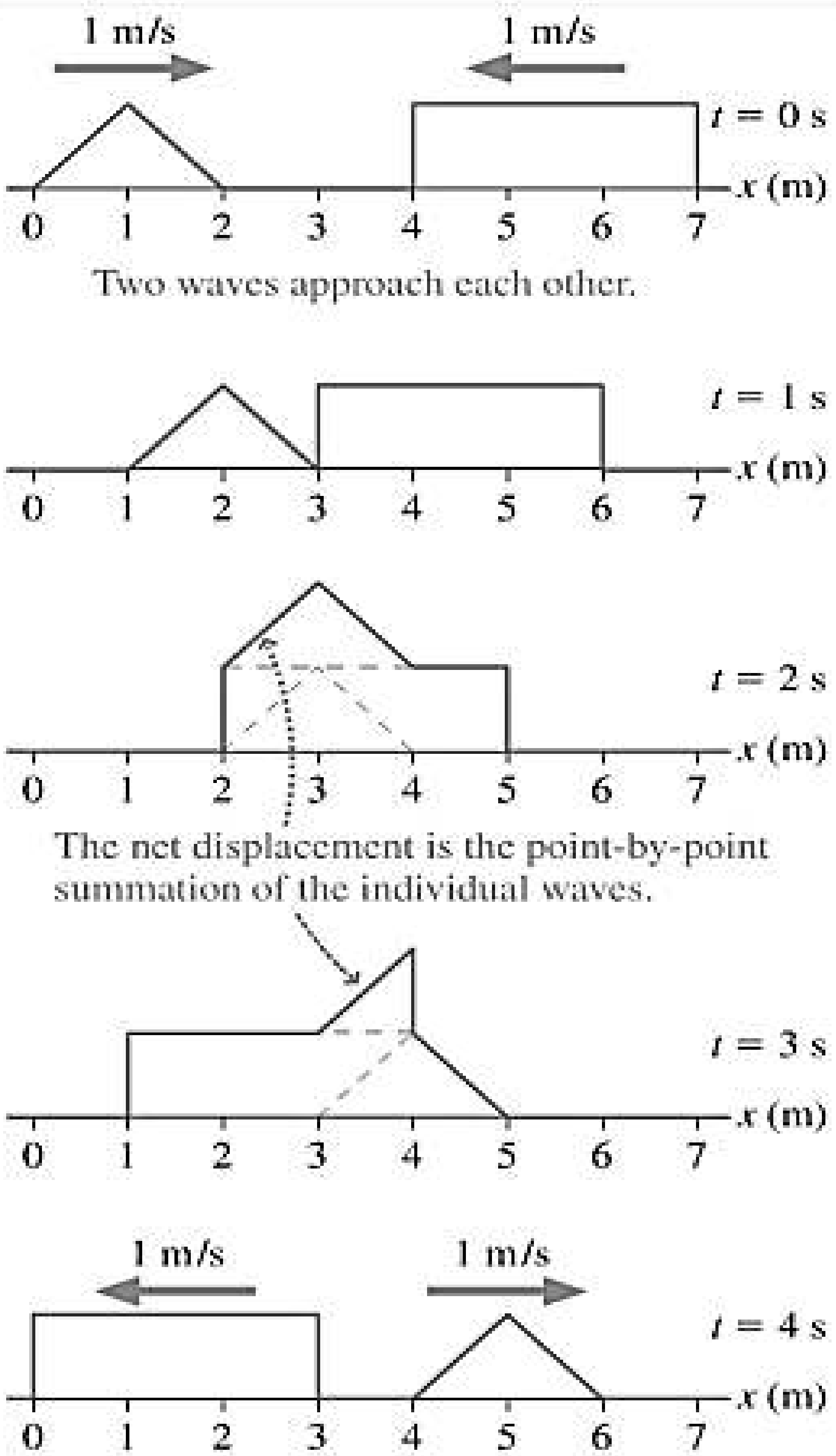
PRINCIPLE OF INTERFERENCE

Wave phenomena that occur when two or more periodic waves with the same frequency overlap in the same region of space are grouped under the heading of interference. Standing waves are a simple example of an interference effect. Two waves with the same frequency and amplitude, traveling in opposite direction in a medium, combine to produce a standing-wave pattern, with nodes and antinodes that do not move. When interference causes an increase in amplitude, it is called *constructive interference*, and that the two waves reinforce each other. When interference causes a decrease in amplitude, it is called *destructive interference or cancellation.*

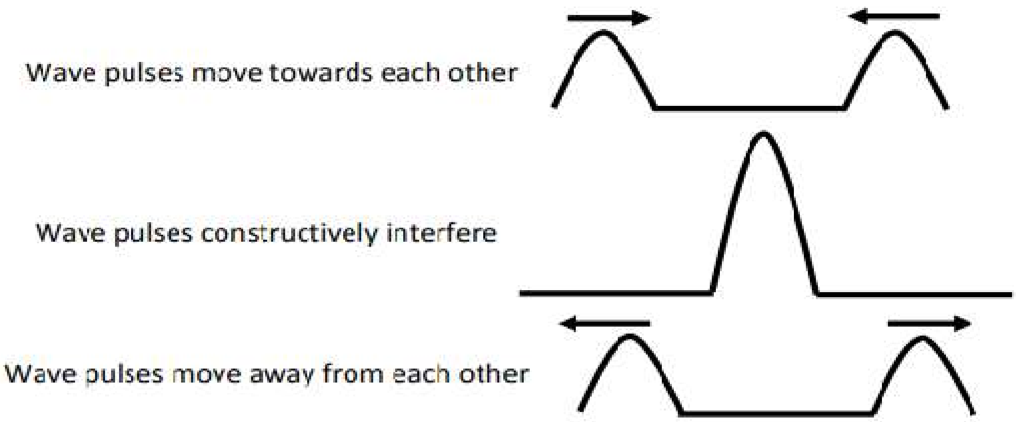
When two or more waves are simultaneously present at a single point in space, the displacement of the medium at that point is the sum of the displacements due to each individual wave.

$$D_{net} = D_1 + D_2 + \cdots = \sum D_i$$

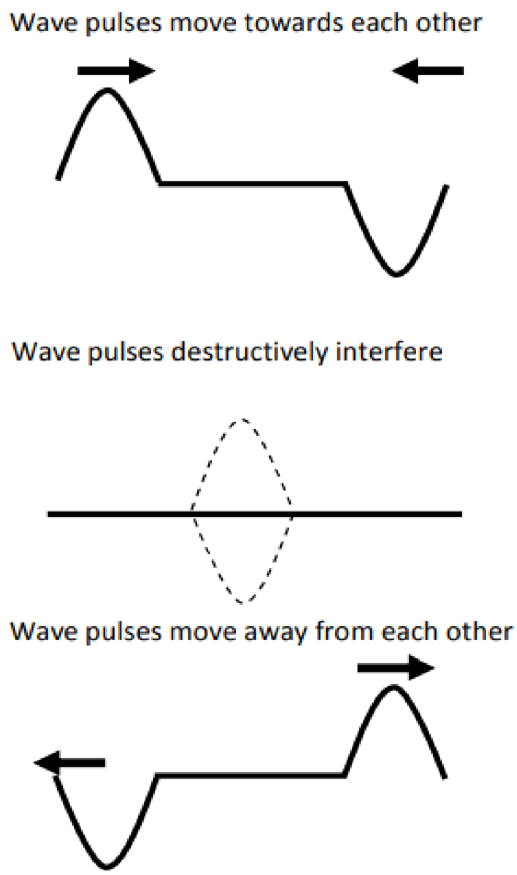
ILLUSTRATION OF INTERFERENCE PRINCIPLE

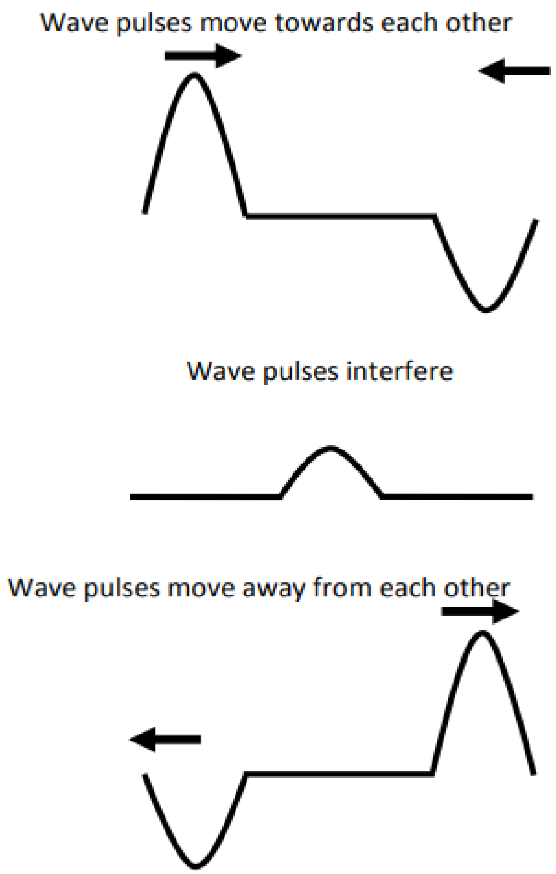


CONSTRUCTIVE INTERFERENCE



DESTRUCTIVE INTERFERENCE





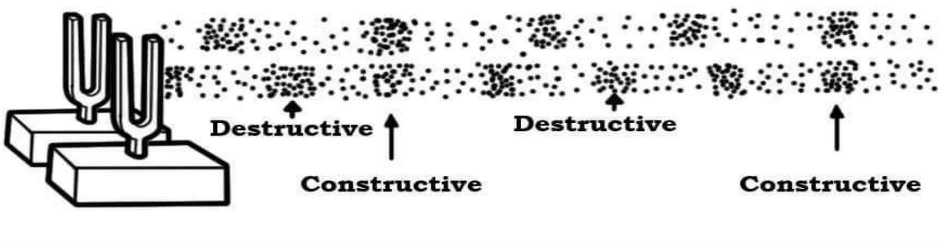
BEATS

For sound waves, interference of two nearly equal frequencies produces intensity variations called beats; the closer the two frequencies, the longer the period between beats. Pilots, for example, synchronize airplane engines by reducing the beat frequency toward zero; musicians use the same trick to tune instruments.

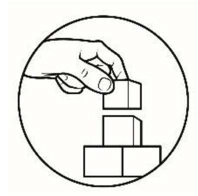
BEAT FREQUENCY

Beats are the periodic variation in loudness of two sounds played together.

Beat frequency = $f2 - f1$



What is the beat frequency when a 256 Hz and a 260 Hz tuning fork are sounded together?



What's More

Activity 1.3. I AM PUZZLED.

On a separate sheet of paper, supply the letters needed to make each sentence correct.

1. How many wavelengths pass by you in one second is described as the wave's ____________.

F				**U**				**Y**

2. ___________ is a mechanical longitudinal wave that we hear with our ears.

S		**U**		

3. When sound waves interfere together and result in a quieter sound it is called __________ interference.

D				**R**						**E**

4. Sound is a ________ wave with compressions and rarefactions.

L					**T**						**L**

5. All __________cause sound.

	I					**I**		**N**	

6. When particles in air get squished together as the wave passes by it is called a _________.

			P					**I**		**N**

7. The distance between successive compressions in a longitudinal wave is called its _____________ .

W					**E**				**H**

8. When sound waves interfere together and result in a louder sound it is called __________ interference.

C				**T**					**I**		**E**

9. When particles in air spread farther apart after the compression of the wave passes by it is called a_________ .

R				**F**						**N**

10. Sound requires a medium to travel through because it is a ________ wave.

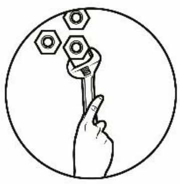
T									**E**

What I Have Learned

ACTIVITY 1.4. AM INCOMPLETE...

On a separate sheet of paper, supply word or group of words to make the sentence correct.

1. ____________ is the phenomenon that occurs when two waves meet while traveling along the same medium.
2. If two upward displaced pulses having the same shape meet up with one another while traveling in opposite directions along a medium, the medium will take on the shape of an upward displaced pulse with twice the amplitude of the two interfering pulses. This type of interference is known as ___________ interference.
3. If an upward displaced pulse and a downward displaced pulse having the same shape meet up with one another while traveling in opposite directions along a medium, the two pulses will cancel each other's effect upon the displacement of the medium and the medium will assume the equilibrium position. This type of interference is known as _______ interference.
4. Sound is a pressure wave that consists of compressions and ___________.
5. ________ is the periodic variation in loudness of two sounds played together.



What I Can Do

ACTIVITY 1.5. BEAT ME 1 2 3...

1-sentence to define what is a beat
2-sentences to differentiate constructive interference from destructive interference
3-sentences to summarize what you have learned from interference and beats

Lesson 2

Standing Waves and Doppler Effect

Learning Objective:

1. Apply the condition for standing waves on a string; and
2. Relate the frequency (source dependent) and wavelength of sound with the motion of the source and the listener.

What's In

Activity 2.1. LET'S DO SOME RECALL...

On a separate sheet of paper, provide a word or group of words to make the sentence correct.

1. ___________ is the phenomenon that occurs when two waves meet while traveling along the same medium.
2. If two upward displaced pulses having the same shape meet up with one another while traveling in opposite directions along a medium, the medium will take on the shape of an upward displaced pulse with twice the amplitude of the two interfering pulses. This type of interference is known as __________ interference.
3. If an upward displaced pulse and a downward displaced pulse having the same shape meet up with one another while traveling in opposite directions along a medium, the two pulses will cancel each other's effect upon the displacement of the medium and the medium will assume the equilibrium position. This type of interference is known as _______ interference.
4. Sound is a pressure wave that consists of compressions and __________.
5. ________ is the periodic variation in loudness of two sounds played together.

What's New

Activity 2.2. AM I TRUE... OR FALSE

For guitar strings, each pattern is characterized by some basic traits.

_______ 1. Nodes and antinodes show an alternating pattern.

_______ 2. Either a half-number or a whole number of waves within the pattern are established on the string.

_______ 3. When the string is clamped down in a fixed position, nodal positions (points of no displacement) are established at the ends of the string.

______ 4. By the adding (or subtracting) of one or more nodes (and antinodes), one pattern is related to the next pattern.

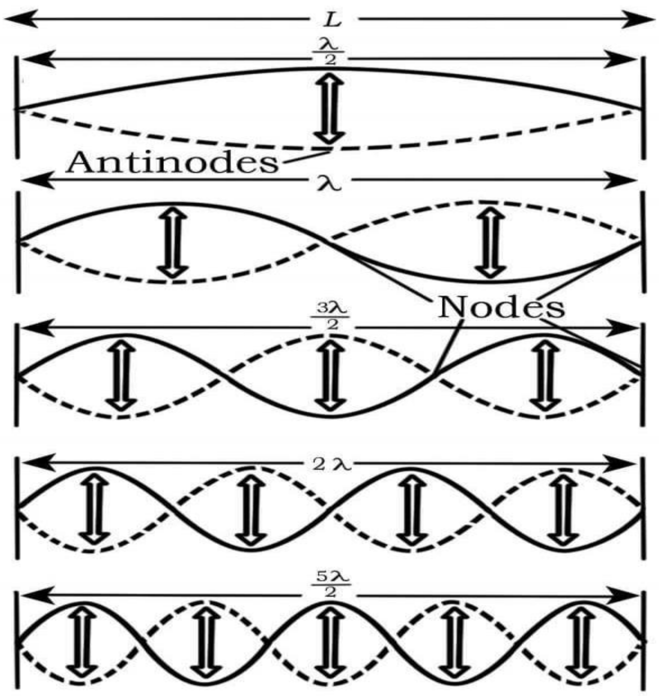
What is It

STANDING WAVES

Sometimes waves do not seem to move. Rather, they just vibrate in place. An example of these waves is seen on the surface of a glass of milk in a refrigerator. The vibrations from the refrigerator motor create waves on the milk that oscillate up and down but do not seem to move across the surface. These waves are formed by the superposition of two or more moving waves. The waves move through each other with their disturbances adding as they go by. If the two waves have the same amplitude and wavelength, then they alternate between constructive and destructive interference. The resultant looks like a wave standing in place and, thus, is called a standing wave. There are other standing waves, such as on guitar strings and in organ pipes. Sound waves in air are produced by the vibrations of a string in violin or in guitar. Characteristic frequencies are based on the length, mass, on the length, mass, and tension of the wire.

STANDING WAVE PATTERNS FOR VIBRATING STRINGS

One of the natural patterns of vibrations for a guitar string is shown in the figure below. In the pattern there are positions along the string (the medium) that appear to be standing still. These positions are referred to as nodes and are labeled below. In between each nodal position, there are other positions that appear to be vibrating back and forth between a large upward displacement to a large downward displacement. These points are referred to as antinodes. There is an alternating pattern of nodal and antinodal positions in a standing wave pattern.



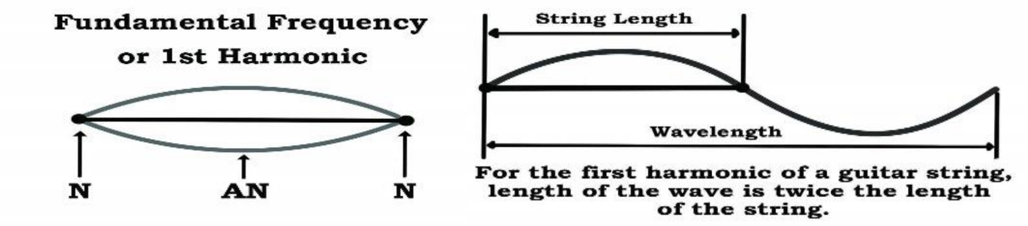
The pattern above is not the only pattern of vibration for a guitar string. There are a variety of patterns by which the guitar string could naturally vibrate. The pattern is associated with one of the natural frequencies of the guitar strings.

The standing wave pattern is referred to as a harmonic of the instrument (in this case, the guitar string). For guitar strings, each pattern is characterized by some basic traits:

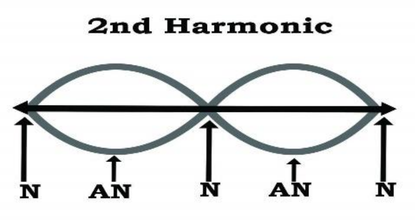
- Nodes and antinodes show an alternating pattern.
- Either a half-number or a whole number of waves within the pattern are established on the string.
- When the string is clamped down in a fixed position, nodal positions (points of no displacement) are established at the ends of the string.
- By the adding (or subtracting) of one or more nodes (and antinodes), one pattern is related to the next pattern.

THE LENGTH-WAVELENGTH RELATIONSHIP

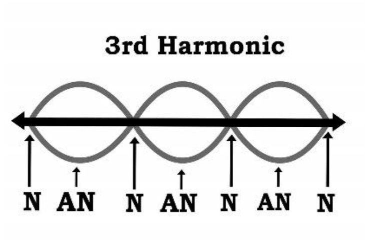
Consider a guitar string vibrating at its natural frequency or harmonic frequency. The ends of the string are attached and fixed in place to the guitar's structure (the bridge at one end and the frets at the other), the ends of the string are unable to move. These ends become nodes or points of no displacement. In between these two nodes at the end of the string, there is one antinode. The most fundamental harmonic for a guitar string is the harmonic is a standing wave having only one antinode positioned between the two nodes on the end of the string. This is the harmonic with the longest wavelength and the lowest frequency. The lowest frequency produced by any particular instrument is known as the *fundamental frequency*. The fundamental frequency is also called the *first harmonic of the instrument.*



The second harmonic of a guitar string is determined by adding one more node between the ends of the guitar string. If a node is added to the pattern, then an antinode must be added as well in order to maintain an alternating pattern of nodes and antinodes. That node must be located midway between the ends of the guitar string in order to create a regular and repeating pattern. The additional node gives the second harmonic a total of three nodes and two antinodes. An investigation of the pattern reveals that there is exactly one full wave within the length of the guitar string. Thus, the length of the string is equal to the length of the wave.



Adding two nodes between the ends of the guitar string signifies the third harmonic of a guitar string. When two nodes are added to the pattern, then two antinodes must be added as well in order to maintain an alternating pattern of nodes and antinodes. The two additional nodes must be evenly spaced between the ends of the guitar string to create a regular and repeating pattern for this harmonic. Thus places them at the one-third mark and the two-thirds mark along the string.



Looking at each harmonic, it results in an additional node and antinode and an additional half of a wave within the string. Once the number of waves in a string is known, then an equation relating the wavelength of the standing wave pattern to the length of the string can be algebraically determined.

$$L=\frac{1}{2}\lambda \xrightarrow{\text{algebra}} \lambda=\frac{2}{1}L \qquad L=\frac{2}{2}\lambda \xrightarrow{\text{algebra}} \lambda=\frac{2}{2}L \qquad L=\frac{3}{2}\lambda \xrightarrow{\text{algebra}} \lambda=\frac{2}{3}L \qquad L=\frac{4}{2}\lambda \xrightarrow{\text{algebra}} \lambda=\frac{2}{4}L$$

Harmonic #	# of Waves in String	# of Nodes	# of Anti-nodes	Length-Wavelength Relationship
1	1/2	2	1	Wavelength = (2/1)*L
2	1 or 2/2	3	2	Wavelength = (2/2)*L
3	3/2	4	3	Wavelength = (2/3)*L
4	2 or 4/2	5	4	Wavelength = (2/4)*L
5	5/2	6	5	Wavelength = (2/5)*L

CALCULATING THE HARMONIC FREQUENCIES

Consider a 90-cm long guitar string that has a fundamental frequency (1st harmonic) of 400 Hz. For the first harmonic, the wavelength of the wave pattern would be two times the length of the string; thus, the wavelength is 180 cm or 1.80 m. The *speed* of the standing wave can now be determined from the wavelength and the frequency. The speed of the standing wave is

speed = frequency • wavelength
speed = 400 Hz • 1.8 m

speed = 720 m/s

This speed of 720 m/s corresponds to the speed of any wave within the guitar string. Since *the speed of a wave is dependent upon the properties of the medium* (and not upon the properties of the wave), every wave will have the same speed in this string regardless of its frequency and its wavelength. So the standing wave pattern associated with the second harmonic, third harmonic, fourth harmonic, etc. will also have this speed of 720 m/s. A change in frequency or wavelength will NOT cause a change in speed.

Using the *table above,* the wavelength of the second harmonic (denoted by the symbol λ_2) would be 0.9 m (the same as the length of the string). The speed of the standing wave pattern (denoted by the symbol v) is still 720 m/s. Now the wave equation can be used to determine the frequency of the second harmonic (denoted by the symbol f_2).

speed = frequency • wavelength
frequency = speed/wavelength

$$f_2 = v / \lambda_2$$

$$f_2 = (7200 \text{ m/s})/(0.9 \text{ m})$$

$$\mathbf{f_2 = 800\ Hz}$$

This same process can be repeated for the third harmonic. Using the table above, the wavelength of the third harmonic (denoted by the symbol λ_3) would be 0.6m (two-thirds of the length of the string). The speed of the standing wave pattern (denoted by the symbol v) is still 720 m/s. Now the wave equation can be used to determine the frequency of the third harmonic (denoted by the symbol f_3).

speed = frequency • wavelength
frequency = speed/wavelength

$$f_3 = v / \lambda_3$$

$$f_3 = (720 \text{ m/s})/(0.6 \text{ m})$$

$$\mathbf{f_3 = 1200\ Hz}$$

DOPPLER EFFECT

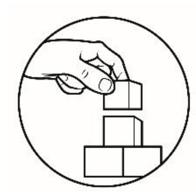
The Doppler effect is a phenomenon observed whenever the source of waves is moving with respect to an observer. It can be described as the effect produced by a moving source of waves in which there is an apparent upward shift in frequency for the observer and the source are approaching and an apparent downward shift in frequency when the observer and the source is receding. It can be observed to occur with all types of waves like in water waves, sound waves, and light waves.

It is observed because the distance between the source of sound and the observer is changing. The distance is *decreasing* if the source and the observer are approaching toward each other. The distance is *increasing* if the source and the observer are receding from each other.

The source of sound *always emits the same frequency*. Thus, for the same period of time, the same number of waves must fit between the source and the observer. The waves can be spread apart if the distance is longer. Waves must therefore be compressed into a smaller distance. In this case, if the source is moving towards the observer, the observer perceives sound waves reaching him or her at a *more frequent rate (high pitch).* If the source is moving away from the observer, the observer perceives sound waves reaching him or her at a *less frequent rate (low pitch).* The source puts out the same frequency; the observer only perceives a different frequency because of the relative motion between them. Thus, Doppler Effect is a shift in the apparent or observed frequency and not a shift in the actual frequency at which the source vibrates.

Doppler shift $f_o = f_s\left(\frac{v \pm v_o}{v \mp v_s}\right)$	Stationary observer	Observer moving towards source	Observer moving away from source
Stationary source	$f_o = f_s$	$f_o = f_s\left(\frac{v + v_o}{v}\right)$	$f_o = f_s\left(\frac{v - v_o}{v}\right)$
Source moving towards observer	$f_o = f_s\left(\frac{v}{v - v_s}\right)$	$f_o = f_s\left(\frac{v + v_o}{v - v_s}\right)$	$f_o = f_s\left(\frac{v - v_o}{v - v_s}\right)$
Source moving away from observer	$f_o = f_s\left(\frac{v}{v + v_s}\right)$	$f_o = f_s\left(\frac{v + v_o}{v + v_s}\right)$	$f_o = f_s\left(\frac{v - v_o}{v + v_s}\right)$

The table above shows different Doppler Effect equations where f_o is the frequency observed by the stationary observer, f_s is the frequency produced by the moving source, v is the speed of sound, v_s is the constant speed of the source, and the top sign is for the source approaching the observer and the bottom sign is for the source departing from the observer.



What's More

Activity 3. 4. LET'S COMPUTE…

1. Determine the length of guitar string required to produce a fundamental frequency (1st harmonic) of 300 Hz. The speed of waves in a particular guitar string is known to be 50 m/s.

2. A guitar string with a length of 75.0 cm is plucked. The speed of a wave in the string is 400 m/sec. Calculate the frequency of the first, second, and third harmonics.

What I Have Learned

Activity 3.5. REMEMBER ME…

On a separate sheet of paper, identify whether the sentence is TRUE, otherwise FALSE.

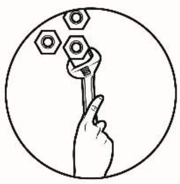
______ 1. There is an alternating pattern of nodes and antinodes.

______ 2. There are always a whole number of waves within the pattern established on the string.

______ 3. Nodal positions (points of no displacement) are established at the ends of the string where the string is clamped down in a fixed position.

______ 4. One pattern is not related to the next pattern by the addition (or subtraction) of one or more nodes (and antinodes).

______ 5. The Doppler Effect is a phenomenon observed whenever the source of waves is moving with respect to an observer.

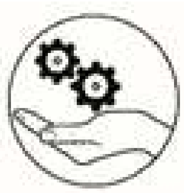


What I Can Do

ACTIVITY 3.6. *COMPLETE ME PLEASE…*

On a separate sheet, complete the table below by considering a 100-cm long guitar string that has a fundamental frequency (1st harmonic) of 355 Hz.

Harmonic #	Frequency (Hz)	Wavelength (m)	Speed (m/s)	f_n / f_1	λ_n / λ_1
1	355	1	355	1	1/1
2	710	0.5	355	2	1/2
3	1065	0.3333	355	3	1/3
4					
5					



Additional Activities

On a separate sheet of paper, cite at least five situations showing Doppler Effect.

Assessment

Choose the best answer. Write the letter of your choice on a separate sheet of paper.

1. What will happen when a compression interferes with another compression?
   a. They combine to create a larger compression.
   b. They combine to create a rarefaction.
   c. They counteract and diminish.
   d. None of the above.

2. What is frequency?
   a. The time interval between two consecutive waves.
   b. The number of waves or cycles generated per second.
   c. The maximum displacement of a wave from its equilibrium position.
   d. The distance between two identical positions on two consecutive waves.

3. What is interference?
   a. It occurs when two or more waves overlap and combine.
   b. It occurs when two or more waves combine and neutralize each other.
   c. It happens when one wave travels alone.
   d. None of these

4. What waves are characterized by the vibrations that move perpendicular to the direction of the wave?
   a. electromagnetic waves
   b. transverse waves
   c. light waves
   d. medium

5. Which of the following statements is TRUE when two waves temporarily interfere with each other then resume their course of movement?
   a. Both waves counteracted and cease to exist.
   b. They take on and keep a new amplitude based on the result of the interference until the end of the movement.
   c. They are not affected by the interference and maintain their original amplitude throughout the movement.
   d. They are temporarily affected by the interference, created new amplitude but resume on their original amplitude until the end of the movement.

6. What is the beat frequency if a 400 Hz and a 396 Hz sounds are heard by Naz?
   a. 1 Hz b. 2 Hz c. 3 Hz d. 4 Hz

7. What causes sound when you pluck the string of a guitar?
   a. metal on guitar
   b. wood of guitar
   c. vibrations of string
   d. none of these

8. Which of the following statements best describes "beats"?
   a. The regular pulsing of loudness of a sound which is heard when 2 sources produce sounds of the same frequency.
   b. The regular pulsing of a pitch of a sound which heard when 2 sources produce sounds of slightly different frequency
   c. The regular pulsing of of loudness of a sound which is heard when 2 sources produce sounds of slightly different frequency.
   d. The regular pulsing of a sound giving a characteristic tone/ timbre which is heard when two sources produce sounds of slightly different frequency.

9. Consider a 90-cm long guitar string that has a fundamental frequency (1st harmonic) of 400 Hz.

a. 222.2 Hz   b. 444.4 Hz   c. 666.2 Hz   d. 3600 Hz

10. A guitar string has length of .50 m and produces a wave speed of 565 m/s along it. What is the frequency of the 3^{rd} harmonic?

a. 93.2 Hz   b. 282.5 Hz   c. 1130 Hz   d. 1712 Hz

Answer Key

PRE-ASSESSMENT
1. b
2. b
3. a
4. b
5. d
6. c
7. c
8. c
9. d
10. a

POST-ASSESSMENT
1. a
2. b
3. b
4. b
5. d
6. d
7. c
8. c
9. a
10. d

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EDITOR'S NOTE

This Self-learning Module (SLM) was developed by DepEd SOCCSKSARGEN with the primary objective of preparing for and addressing the new normal. Contents of this module were based on DepEd's Most Essential Learning Competencies (MELC). This is a supplementary material to be used by all learners of SOCCSKSARGEN Region in all public schools beginning SY 2020-2021. The process of LR development was observed in the production of this module. This is version 1.0. We highly encourage feedback, comments, and recommendations

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