

Waves, Sound, & Light

Name: _____

Block: _____

HS-PS4-1, 4-3, 4-4:

HS-PS4-1. **Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.** [Clarification Statement: Examples of data could include electromagnetic radiation traveling in a vacuum and glass, sound waves traveling through air and water, and seismic waves traveling through the Earth.] [Assessment Boundary: Assessment is limited to algebraic relationships and describing those relationships qualitatively.]

HS-PS4-3. **Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other.** [Clarification Statement: Emphasis is on how the experimental evidence supports the claim and how a theory is generally modified in light of new evidence. Examples of a phenomenon could include resonance, interference, diffraction, and photoelectric effect.] [Assessment Boundary: Assessment does not include using quantum theory.]

HS-PS4-4. **Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.** [Clarification Statement: Emphasis is on the idea that photons associated with different frequencies of light have different energies, and the damage to living tissue from electromagnetic radiation depends on the energy of the radiation. Examples of published materials could include trade books, magazines, web resources, videos, and other passages that may reflect bias.] [Assessment Boundary: Assessment is limited to qualitative descriptions.]

I CAN...

- **LT1 - Distinguish between transverse and longitudinal waves as well as mechanical and electromagnetic waves.**
- **LT2 - Identify: wavelength, amplitude, crest, trough, frequency, and period, given a visual representation.**
- **LT3 - Solve problems using the relationships between velocity, wavelength, frequency, and period.**
- **LT4 - Recognize that waves transfer energy and not matter.**
- **LT5 - Recognize that the speed of a wave is dependent upon the material/medium through which the wave travels.**
- **LT6 - Describe and identify types of wave interference.**
- **LT7 - Calculate the frequencies of waves that form standing waves on strings fixed at both ends, pipes open on both ends and a pipe open on one end and closed on the other.**
- **LT8 - Identify and describe refraction.**
- **LT9 - Apply the law of reflection.**
- **LT10 - Order the wave types of the electromagnetic spectrum (including visible colors) according to frequency, energy, and wavelength.**
- **LT11 - Recognize evidence for both the wave nature and the particle nature of light.**

Example Questions:

LT1

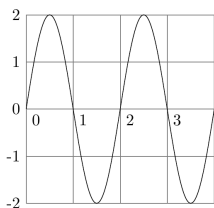
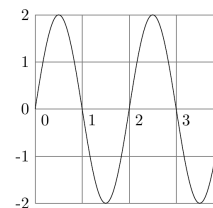
A. Water waves are classified as mechanical waves and _____ waves.

B. Sound waves are classified as mechanical waves and _____ waves.

C. Radio waves are classified as _____ and transverse waves.

LT2

D. Label the wavelength and amplitude of the wave depicted on the graph at right:
Also label a crest and a trough.



E. Determine the period and frequency of the wave depicted on the graph left:

LT3

F. A sound wave has a frequency of 440 Hz. What's the period of the wave?

G. A water wave has a period of 0.25 seconds. What's the wave's frequency?

H. A light wave in empty space has a frequency of 5.00×10^{14} Hz. Calculate its wavelength.

I. A sound wave in air has a wavelength of 1.25 m. Calculate its frequency.

J. A sound wave in water has a frequency of 512 Hz and wavelength of 2.95 m. What's its speed?

K. A light wave travels at 2.25×10^8 m/s in a piece of glass. If its wavelength is 650×10^{-9} m, what is its period?

LT4

L. When a lifeguard blows her whistle to get some swimmers' attention, does any air from the whistle go into the swimmers' ears? What does go in the swimmers' ears?

LT5

M. Starting with the fastest, rank the speed of sound in the following 3 media: steam, water, ice?

N. Why does sound travel faster in warm air than in cold air?

O. Do all frequencies of light travel the same speed in glass? Give evidence.

LT6

P. When two crests of different waves meet (or two troughs), what type of interference occurs?

Q. When a crest of one wave meets the trough of another wave, what type of interference occurs?

R. What is responsible for the phenomena of beats? Why do sound beats occur?

S. If a beat frequency of 3 Hz is heard when a tuning fork of 256 Hz is played with a piano string, what are the two possible frequencies of the piano string?

LT7

T. If a string (fixed at both ends) of length 0.75 m vibrates at a fundamental frequency of 308 Hz, how fast do waves travel along the string?

U. If a pipe closed at one end resonates at a fundamental frequency of 256 Hz when its length is 0.325 m, what is the speed of sound in the air inside the pipe?

V. If the speed of sound is 343 m/s and a pipe open on both ends is cut so that its length corresponds to a fundamental note of 512 Hz, how long is the pipe?

LT8

W. Why does light bend (refract) when entering a new medium? (i.e. What is the cause of refraction?)

LT9

X. A light wave is incident on a mirror at an angle of 35 degrees with the normal line. Sketch this below, and indicate the direction and angle of the incident and reflected rays.

LT10

Y. List the seven major divisions of the electromagnetic spectrum in order of increasing frequency?

Z. If you were asked to order those same seven divisions in order of increasing energy, how would you answer change?

LT11--

AA. Conduct a Google Search typing in the following: Double Slit Experiment site:*.edu
Use the results to determine what property of light (wave or particle) this type of experiment supports.
Describe how it does so.

AB. Conduct a Google Search typing in the following: Photoelectric Effect site:*.edu
Use the results to determine what property of light (wave or particle) this type of experiment supports.
Describe how it does so.