

1. Draw a picture of a wave and label wavelength and amplitude.



Waves





What is a wave? A wave is simply energy moving from

one place to another.

It always needs something to move through

Example:



Sound is the wave and the air is the medium





Period

Answer to the question: How long does it take to happen once?

$$T = \frac{time}{\# of cycles}$$

The amount of time it takes to complete one cycle, or the time equivalent of one wavelength Symbol = T Units = seconds (s)



Springs/pendulums as waves





https://www.youtube.com/watch?v=7_AiV12XBbI



Practice

Jimmy is counting the passing waves of a struggling Jane.... If Jimmy sees 6 waves every 5 seconds, what is the frequency of the waves?

Frequency is the number of waves per second so 6 waves every 5 seconds is 6/5 = 1.2 hz

What is the period of the waves?

$$f = \frac{1}{T}$$
 $1.2 = \frac{1}{T}$ $T = \frac{1}{1.2} = 0.833s$

Wave Speed

The speed at which a waves moves through space

$$v = \frac{d}{t}$$
$$v = \frac{\lambda}{T} = \lambda * f$$

Units = m/s



isvr



The limit of human hearing is 20 hz to 20,000 hz. If the speed of sound is around 340 m/s, what is that range in wavelengths?

$$v = \lambda * f$$

 $340 = \lambda * 20$ $340 = \lambda * 20000$

 $\lambda = 17m$ $\lambda = 0.017m$



Transverse Waves

Particle motion is perpendicular to the motion of the wave

Wave moves forward and the particles move up and down



Longitudinal waves

Particles move in the same direction as the wave



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NOTE: "C" stands for compression and "R" stands for rarefaction

Practice

Measure the wavelength, amplitude, period, frequency and velocity of the following waves:









Properties of Waves



Wave Interference

What happens when two waves run into each other? They interfere in two different ways:

> 1.5 1.25

0.75

0.25

10

15

Constructive Interference:

The amplitudes of the waves add together because they are in phase

Destructive Interference:

The amplitudes of the waves subtract because the waves are out of phase

Wave on a string

Superposition of Waves



Standing waves

When a wave interferes with itself setting up a pattern of constructive and destructive interference

Antinode

Node

- https://www.youtube.com/watch?v=wYoxOJDrZzw
- https://www.youtube.com/watch?v=NpEevfOU4Z8
- Wave on a string
- Slinky

Reflection

When a wave bounces back because of an encounter with another medium.



Bell Ringer

- Microwaves have a frequency of 300 x 10⁶ Hz. If the speed of light is 3x10⁸ m/s, what is the wavelength of a microwave?
- X-rays have a wavelength of 1 x 10[^]-9 meters. What is their frequency?

Law of Reflection

The angle of the reflected wave will always equal the angle of the incident (approaching) wave.



One-way mirrors

https://www.youtube.com/watch?v=4kKL320pewI

Practice

How far back from the mirror does Jimmy need to move in order for him to see his entire reflection?



He'll NEVER be able to see his whole self.... Unless he buys a bigger mirror!



When a wave bends (slows down) because of a change in medium.









https://www.youtube.com/watch?v=EtsXgO DHMWk

Snell's Law



$n_1\sin(\theta_1) = n_2\sin(\theta_2)$

n is the index of refraction

$(f = 5.09 \times 10^{14} \text{ Hz})$	
0ť	
$\lambda = 5.9 \times 10^{-7} \text{ m})$	
Air	1.00
Canada Balsam	1.53
Corn oil	1.47
Diamond	2.42
Ethyl alcohol	1.36
Glass, crown	1.52
Glass, flint	1.66
Glycerol	1.47
Lucite	1.50
Quartz, fused	1.46
Sodium chloride	1.54
Water	1.33
Zircon	1.92

Practice

Jane is shooting a Laser at Jimmy who she has encased in a sheet of glass. What does the index of refraction of the glass need to be so that she can slow roast Jimmy?













Double Slit Diffraction



https://www.youtube.com/watch?v=Iuv6hY 6zsdo