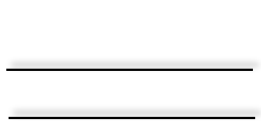
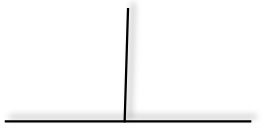
Name: _____ Class: _____ Date: KEY

Mechanical Waves

ESSENTIAL QUESTION: How do mechanical waves transfer energy through matter?

VOCAB

parallel	perpendicular
	
Two lines that will never cross.	Two lines that cross at a right angle.

TOPIC QUESTIONS:

1 What is a wave?

A wave is a disturbance that transmits ENERGY through matter or empty space.

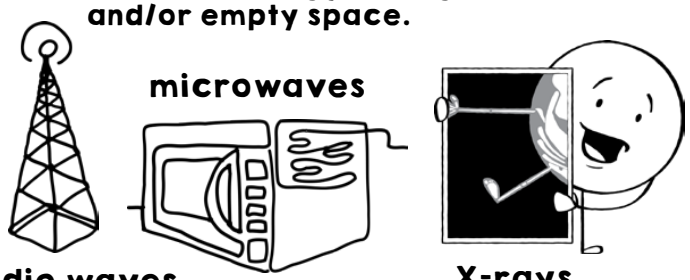
There are two types of waves:

Mechanical & **Electromagnetic**

Transmit energy through matter.

water waves | sound waves | seismic waves

Transmit energy through matter and/or empty space.



radio waves | microwaves | X-rays

2 What is a medium?

A medium is the matter through which a mechanical wave can travel.

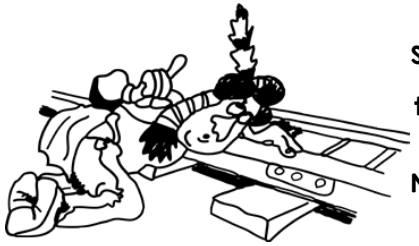
Sound waves can travel through a **gas** like the air.

Water and sound waves can travel through a **liquid** like the ocean.

Seismic and sound waves can travel through a **solid** like the Earth's crust.

Do sound waves travel fastest through solids, liquids, or gases?

solids



Sound waves travel fastest through solids because there are more particles and they have stronger bonds between them. Sound waves travel 14 times faster through iron than through air! This is why Native Americans used to listen for trains by putting their ears on the tracks!

TOPIC QUESTIONS:

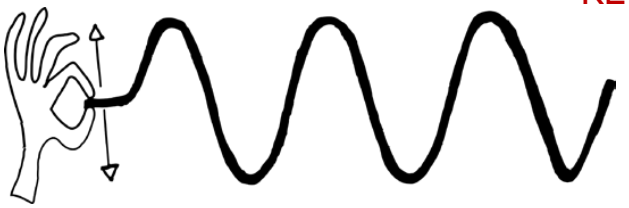
KEY

3

What are the main types of mechanical waves and how do they transfer energy?

Transverse Waves

The particles of the medium vibrate in a direction perpendicular to the direction that the wave moves.



Quick Watch: World Record for Stadium Wave https://tinyurl.com/zn7hr6h

DO

Describe the motion of an individual fan during 'The Wave'. How is this an example of a transverse wave?

Each fan stands up and sits down when 'The Wave' energy comes to him/her. The fans are like particles through which energy is transferred, but which do not move.

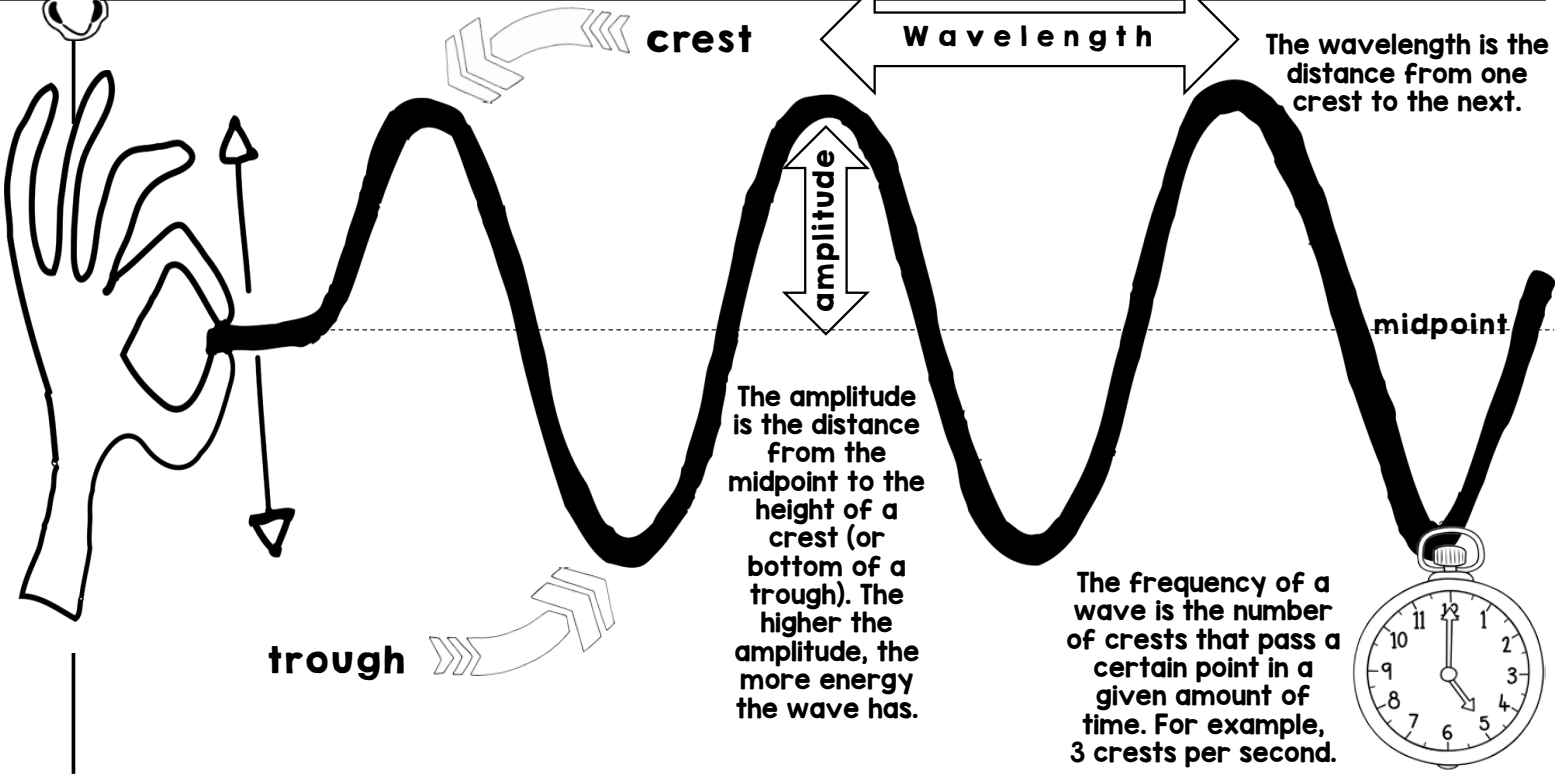
Longitudinal Waves

The particles of the medium vibrate in a direction parallel to the direction that the wave moves.

Slinkys are great examples of longitudinal waves!

4

What is the anatomy of a transverse wave?



The wavelength is the distance from one crest to the next.

The amplitude is the distance from the midpoint to the height of a crest (or bottom of a trough). The higher the amplitude, the more energy the wave has.

The frequency of a wave is the number of crests that pass a certain point in a given amount of time. For example, 3 crests per second.

KEY

TOPIC QUESTIONS:

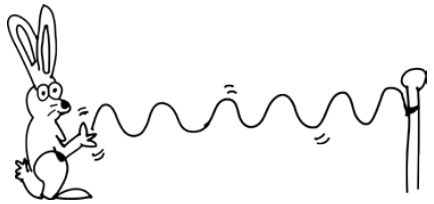
4

What is the anatomy of a transverse wave?

Do Describe the relative motion of each animal's transverse wave below using the terms WAVELENGTH, AMPLITUDE, FREQUENCY (very high, high, low, very low).

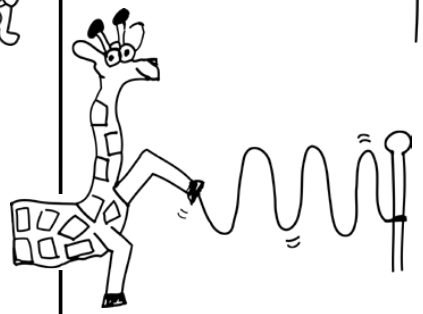
Tommy Turtle's wave has . . .

a long wavelength, a low amplitude and a very low frequency



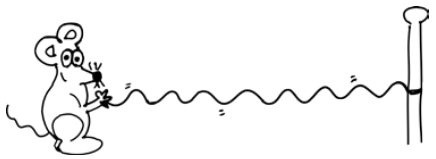
Rhonda Rabbit's wave has . . .

a short wavelength, a high amplitude and a high frequency



Girard Giraffe's wave has . . .

a very short wavelength, a very high amplitude and a very high frequency



Molly Mouse's wave has . . .

a short wavelength, a very low amplitude and a high frequency

5

What are the units used to measure wavelength, frequency, and a wave's speed?

wavelength

Wavelength is abbreviated by the Greek letter lambda: λ = meters

Depending on the size of the wave, the wavelength can be measured in meters (m), centimeters (cm), millimeters (mm), or even nanometers (nm).

frequency

Frequency, f, is measured in a unit called Hertz, abbreviated Hz.

$$Hz = \frac{\text{cycles}}{\text{second}}$$

Hertz are cycles per second, or how many wave crests pass a certain point per second.

wave speed

The speed (or velocity, v) of a wave can be calculated using the Wave Equation:

$$v = \lambda \times f$$

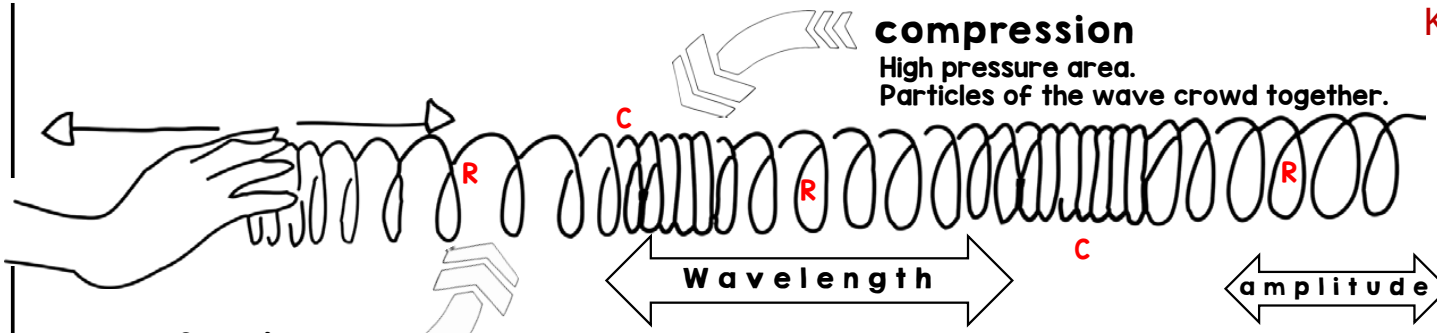
The Wave Equation is written as velocity equals wavelength times frequency. The units for velocity are meters per second.

TOPIC QUESTIONS:

KEY

6

What is the anatomy of a longitudinal wave?

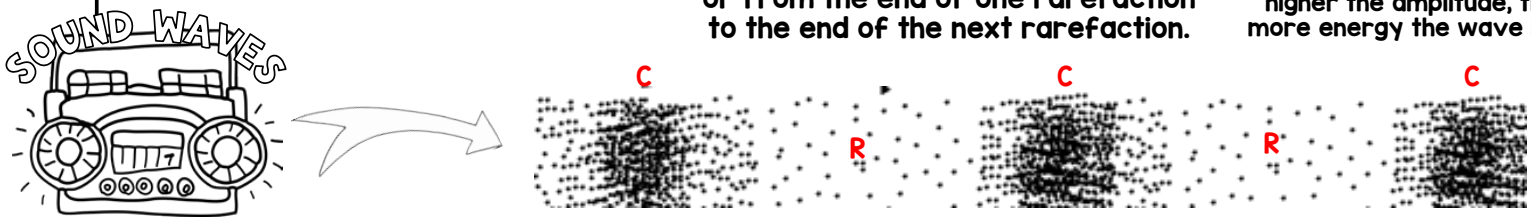


compression
High pressure area.
Particles of the wave crowd together.

rarefaction
Low pressure area.
Particles of the wave spread apart.

Wavelength
The wavelength is the distance from the end of one compression to the end of the next compression or from the end of one rarefaction to the end of the next rarefaction.

amplitude
The amplitude is the change in pressure between the rarefaction and compression points. The higher the amplitude, the more energy the wave has.



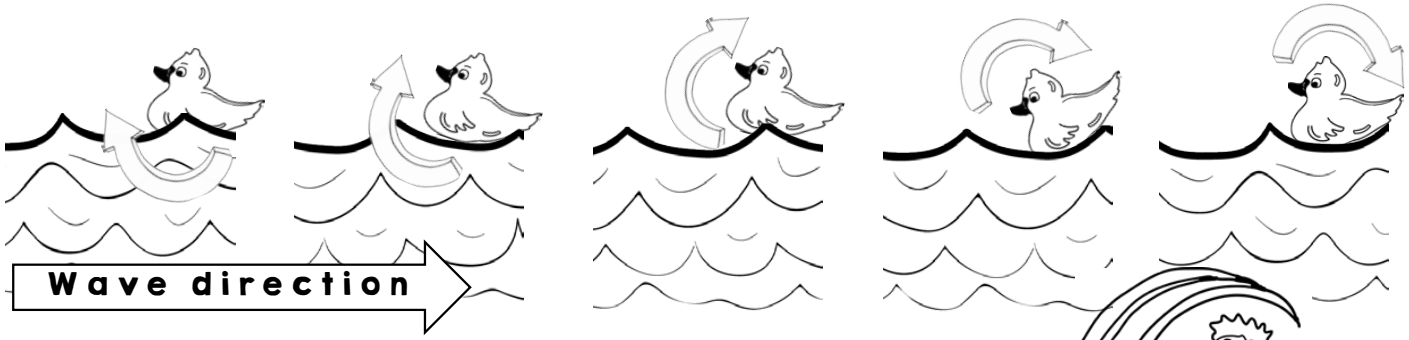
Do Label all of the rarefactions and compressions of both examples of longitudinal waves above.

7

What is a surface wave?

A surface wave is another type of mechanical wave that occurs in water. Particles move both parallel and perpendicular to the motion of the wave and their motion becomes circular.

This duck's position does not change as the surface waves pass beneath him:



Ocean waves are a type of surface wave created by winds. Energy is moving through the water, but the water particles themselves are traveling in circular paths. The wave motion changes when the waves hit the shore. Surfers take advantage of the wave collapsing.

COWABUNGA!