PhyzSpringboard: Introduction to Waves

BIG IDEAS

1. a. Construct two lists: one of methods of communication that **involve** waves, the other of methods of communication that **don't involve** waves. A method of communication is a means by which information or ideas can be transferred from your mind to someone else's—information like how to build a dog house. Classify *and add* to the following: speaking/ listening, writing/ reading, television, Morse code. Consider only whether or not the method involves waves outside your body.

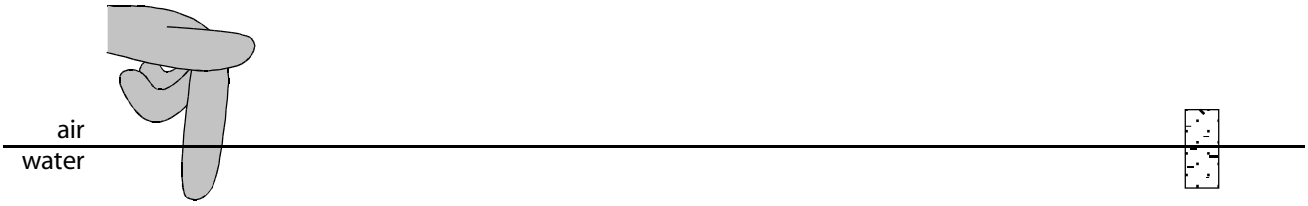
WAVES	WAVES	NO WAVES
speaking/listening	radio	Braille
writing/reading	semaphore	
television		
Morse code		

b. Which of the five senses is/are activated by wave stimuli? What are the others activated by?

WAVE STIMULATED: sight, hearing. CHEMICALLY STIMULATED: smell, taste. MULTIPLE STIMULI: touch.

2. To understand the most important thing a wave does, consider a cork floating in the still water of a pool. There is also a hand dipped into the pool.

a. Suppose the cork is one meter from the hand and the hand can only move 10 cm. Can the hand cause the cork to move? If so, how; if not, why not?



If the hand jiggles up and down or side to side, it will create waves that will travel across the water to the cork, setting the cork in motion.

b. If the cork went from being at rest to being in motion, what did it gain in the process?

Among other things... kinetic energy.

c. What role—if any—does the **water** play in getting the cork to move? Could the cork have been set into motion if there were no water (or anything else) between the hand and the cork?

The water provides a connecting medium through which the energy can travel from the hand to the cork.

d. What role—if any—does the **hand** play in getting the cork to move? Could the cork have been set into motion if the hand were not there?

The hand is the source of energy.

e. Does water move from the region around the hand to the region around the cork?

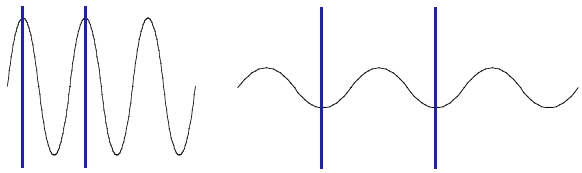
NO!

f. Does this example follow the statement that *waves transfer energy without transferring matter?* Explain.

YES! The energy moves from the hand to the cork without matter moving from the hand to the cork.

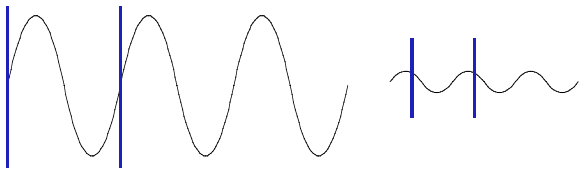
IMPORTANT DETAILS

1.a. Mark the distance associated with one complete **cycle** of each wave shown to the right.

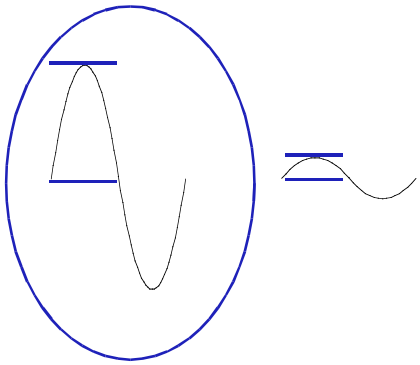


b. What is this distance called, which letter is used to represent it, and how can it be identified on a diagram of a wave?

Wavelength, λ, one complete cycle of the wave, such as from crest to crest, trough to trough, etc.



2.a. Which single wave carries more **energy**?

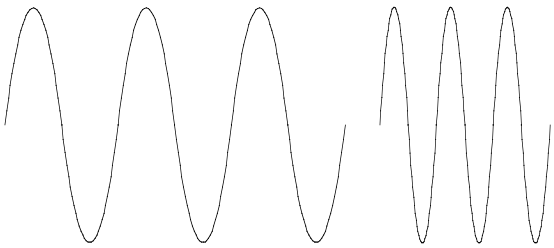


b. What characteristic of a wave indicates the energy it carries and which letter is used to represent it?

Amplitude, A.

c. Mark the distance associated with this quantity for each wave to the right.

3. Examine the two waves shown to the right and consider the questions about the sources of these waves. (Both waves travel at the same speed.)



a. Which wave source oscillated with the longer **period**?

The one with the greater wavelength. (Left.)

b. Which oscillated with the higher **frequency**?

The one with the shorter wavelength. (Right.)

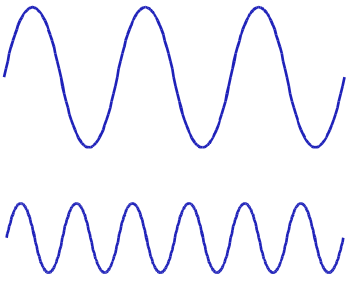
4.a. Which wave delivers more energy in each second?

The one with the shorter wavelength. (Right.)

b. What is the rate of energy transmission called?

Power!

5. It is possible for two waves with different amplitudes and frequencies to deliver energy at the same rate. Explain how this is possible and draw two such waves.



One wave is low frequency/high amplitude and the other is high frequency/low amplitude.