Name _____ Date _____ Class _____

Quick Vocabulary

Lesson 1

compression region of a longitudinal wave where the particles in the medium are closest together

crest highest point on a transverse wave

electromagnetic wave can travel through empty space and through matter

energy ability to cause change

longitudinal wave makes the particles in a medium move parallel to the direction of the wave

mechanical wave travels only through matter

medium material in which a mechanical wave travels

rarefaction region of a longitudinal wave where the particles are farthest apart

transverse wave disturbance is perpendicular to the direction of the wave

trough lowest point on a transverse wave

wave disturbance that transfers energy from one place to another

Lesson 2

amplitude maximum distance particles in a medium move from their rest position as waves pass through the medium

frequency number of wavelengths that pass by a point each second

wavelength distance from one point on a wave to the same point on the next wave

Lesson 3

absorption transfer of energy by a wave to the medium through which it travels

constructive pertaining to building or putting parts together to make a whole

diffraction change in direction of a wave when it travels by the edge of an object or through an opening

interference waves that overlap combine to form a new wave

law of reflection angle of incidence equals angle of reflection

normal perpendicular to or forming a right angle with a line or plane

reflection bouncing of a wave off a surface

refraction wave changes direction, because its speed changes

transmission passage of light through an object

Lesson Outline for Teaching

Lesson 1: What are waves?

A. What are waves?

1. A(n) wave is a disturbance that transfers energy from one place to another without transferring matter.
2. Waves transfer energy away from the source of the energy.
3. Waves transfer energy without transferring matter.
4. Waves transfer energy by pushing and pulling on neighboring particles.

B. Mechanical Waves

1. A wave that can travel only through matter is a mechanical wave.
2. The material in which a mechanical wave travels is called a(n) medium.
3. A(n) transverse wave is a wave in which the disturbance is moving at right angles, or perpendicular, to the direction the wave travels.
4. The highest points on a transverse wave are crests. The lowest points on a transverse wave are troughs.
5. A longitudinal wave makes particles move parallel to the direction that the wave travels.
6. The regions of a longitudinal wave where the particles in the medium are closest together are compressions. The regions of a longitudinal wave where the particles are farthest apart are rarefactions.
7. A vibrating object, such as a drum, is the source of energy that produces mechanical waves.
   a. Each vibration makes a wave.
   b. After an object stops vibrating, waves continue to move.

C. Types of Mechanical Waves

1. All mechanical waves travel only through matter.
2. Sound waves are longitudinal waves that can travel through solids, liquids, and gases.
3. Water waves are a combination of transverse waves and longitudinal waves.
4. Seismic waves are produced when parts of Earth's upper layers move along a fault.

D. Electromagnetic Waves

1. An electromagnetic wave can travel through a(n) empty space and through matter.
2. The type of electromagnetic waves given off by an object depends mainly on the temperature of the object.
3. The Sun's electromagnetic waves carry radiant energy.

Lesson Outline for Teaching

Lesson 2: Wave Properties

A. Amplitude and Energy

1. The amplitude of a wave is the maximum distance that the particles in a medium move from their rest position as the wave passes.
2. For any wave, the larger the amplitude is, the more energy the wave carries.
3. Transverse waves have crests and troughs. The amplitude of these waves is the distance from the rest position to the top of a crest or the bottom of a trough.
4. The amplitude of a(n) longitudinal wave depends on the distance between particles in the compressions and rarefactions. When the amplitude of these waves increases, the particles in the medium get closer together in the compressions and farther apart in the rarefactions.

B. Wavelength

1. Wavelength is the distance from one point on a wave to the same point on the next wave.
2. In a(n) transverse wave, a wavelength is the distance from one crest to the next crest or from one trough to the next trough.
3. In a(n) longitudinal wave, a wavelength is the distance from one compression to the next compression or from one rarefaction to the next rarefaction.

C. Frequency

1. The frequency of a wave is the number of wavelengths that pass by a point each second.
2. Each single vibration of an object produces one wavelength.
3. The unit for frequency is the hertz, abbreviated Hz.
4. As the frequency of a wave increases, the wavelength decreases.

D. Wave Speed

1. Wave speed depends on the type of wave, the temperature, and the medium the wave is traveling through.
2. Mechanical waves, such as sound, usually travel fastest in solids and slowest in gases.
3. Electromagnetic waves travel fastest through a vacuum and slowest through solids.
4. You can calculate the speed of a wave by multiplying its wavelength by its frequency.

Discussion Question

How are the amplitude and energy of a wave related?

The energy carried by a wave increases as the amplitude of the wave increases.

Lesson Outline for Teaching

Lesson 3: Wave Interactions

A. Interaction of Waves with Matter

1. Absorption is the transfer of energy by a wave to the medium through which it travels.
   - **a.** One factor that affects the amount of energy absorbed is the wave in which a wave moves.
   - **b.** All materials absorb electromagnetic waves.
2. Transmission is the passage of light through an object.
3. Reflection is the bouncing of a wave off a surface.
   - **a.** Objects that reflect all visible light appear white.
   - **b.** Objects that do not reflect any visible light appear black.

B. The Law of Reflection

1. All types of waves can be reflected when they hit a surface.
2. The angle at which a wave hits a surface is the same angle at which it bounces off the surface.
   - **a.** The normal is an imaginary line that is perpendicular to a surface.
   - **b.** The angle of incidence is equal to the angle between the normal and an incoming wave.
   - **c.** The angle of reflection is equal to the angle between the normal and an outgoing wave.
3. The angle of incidence and the angle of reflection are equal. This rule is called the law of reflection.

C. Refraction

1. Refraction occurs when a wave changes direction because its speed changes.
2. The greater the change in speed is, the more the wave changes direction.

D. Diffraction

1. The change in direction of a wave when it travels by the edge of an object or travels through an opening is called diffraction.
2. Sound waves spread out as they travel through a doorway because their wavelengths are roughly the same width as the doorway.
3. The wavelengths of light waves are more than a million times smaller than the width of a doorway. As a result, these waves do not spread out as they travel through a doorway.

E. Interference

1. Interference occurs when waves overlap to form a new wave.
2. Constructive interference occurs when a crest overlaps a crest or a trough overlaps a trough.
3. Destructive interference occurs when a crest overlaps a trough.
4. A standing wave can form when two waves with the same wavelength overlap while they are traveling in opposite directions.

Discussion Question

Why can you hear people talking around a corner even when you cannot see them?

Sound waves spread out as they travel through a doorway because the wavelengths of sound waves are roughly the same as the width of the doorway. This allows you to hear people around a corner. The wavelengths of light waves are much smaller than the width of a doorway. As a result, light waves do not spread out as they travel through a doorway, which is why you cannot see people around a corner.