Name _____ Date _____ Class _____

Quick Vocabulary

Chapter 10
Sound and Light

Lesson 1

echo reflected sound wave

longitudinal wave a wave in which particles move in the same direction as the wave

pitch perception of how high or low sounds seem

sound wave longitudinal wave that can travel only through matter

Lesson 2

light ray narrow beam of light that travels in a straight line

light source something that emits light

opaque material through which light does not pass

translucent allows most light to pass through but forms a blurry image

transparent allows almost all light to pass through and forms a clear image

Lesson 3

convert to change from one form into another

cornea transparent tissue layer located on the outside of the eye

iris colored part of the eye

lens transparent object with at least one curved side that causes light to change direction

mirror any reflecting surface

pupil opening to the interior of the eye through which light enters

retina layer of light-sensitive cells in the back of the eye

Lesson Outline For Teaching Chapter 10 Outline

Lesson 1: Sound

A. What is sound?

1. All sounds that people hear travel to the ears as sound waves.
2. Sound waves travel through all kinds of matter—solids, liquids, and gases.
3. Objects that are vibrating produce sound waves.
   a. As the object moves outward, it pushes air molecules closer together, producing a(n) compression.
   b. As the object moves inward, it pulls air molecules farther apart, producing a(n) rarefaction.
   c. A(n) sound wave is a series of rarefactions and compressions.
4. Matter vibrates back and forth in the same direction that the sound waves travel, so sound waves are classified as longitudinal waves.
5. The distance between a point on a wave and the nearest point just like it is called the wavelength.
6. The number of wavelengths that pass a given point in 1 second is a sound wave's frequency; its SI unit is hertz.
7. A sound wave with a(n) high frequency is produced by an object that vibrates quickly.

B. Speeds of Sound Waves

1. The speed of sound waves depends on the kind of material the waves are traveling through.
2. Sound waves generally travel fastest through solids and slowest through gases.
3. Sound waves generally travel faster through warm air and slower through cold air.

C. The Human Ear

1. People hear things when sound waves come into contact with their ears.
2. The outer ear collects sound waves.
3. The middle ear amplifies sound waves. Three tiny bones strengthen the sound waves as they travel to the inner ear.
4. The inner ear changes vibrations to nerve signals that travel to the brain.
5. Humans hear frequencies from 20 Hz to 20,000 Hz.

D. Sound and Pitch

1. How high or low people perceive a sound to be is the pitch of the sound.
2. Sounds with a low frequency have a(n) low pitch.
3. When you speak, you use your vocal cords to make sounds.

E. Sound and Loudness

1. How loud or soft people perceive a sound to be is related to the energy of the sound.
2. The amplitude of a sound wave indicates how much energy the sound has.
3. The loudness of sound can be measured in decibels.

F. Using Sound Waves

1. A sound that is reflected is a(n) echo.
2. Sonar systems use reflected sound to calculate distance. The distance of an object can be calculated from the time difference between when sound leaves the system and when it returns to the system.
3. Bats use echolocation to hunt and to help them navigate.
4. Ultrasound scanners convert high-frequency sound waves to images of internal body parts.

Discussion Question

How are the characteristics of sound waves related to the various attributes of sound?

The pitch of a sound is how high or low the sound is perceived to be; pitch is related to the frequency or the wavelength of the sound wave. The loudness of a sound is how much energy the sound has; loudness is related to the amplitude of the sound wave.

Lesson Outline for Teaching

Lesson 2: Light

A. What is light?

1. Light is a type of wave called a(n) electromagnetic wave.
2. Light waves can move through matter, but they travel fastest when they move through a(n) vacuum.
3. Light waves travel much faster than sound waves.
4. The electromagnetic spectrum includes light waves, X-rays, and radio waves.
5. The wavelengths of light waves are usually measured in nanometers.
6. You perceive different wavelengths of light as different colors.

B. The Interaction of Light and Matter

1. Reflection occurs when light waves bounce off the surface of a material.
2. In transmission, most light waves travel through an object.
3. When absorption occurs, light energy is converted into other forms of energy.
4. A material is transparent if it allows almost all light that stikes it to pass through and forms clear image.
5. A material is translucent if it allows most of the light that strikes it to pass through but forms a blurry image.
6. A material is opaque if light does not pass through it.
7. The law of reflection states that the angle of incidence always equals the angle of reflection.
8. The normal to a surface is a line that is perpendicular to the surface.
9. A(n) light source is an object that emits light.
   a. Light spreads out in all directions from a(n) light source.
   b. A narrow beam of light that travels in a straight line is called a(n) light ray.
10. Many objects reflect light. Reflected light waves travel from an object to your eyes, allowing you to see the object.
11. Dust scatters light. Scattering occurs when light waves traveling in one direction are made to travel in many directions.
12. When light waves travel from one material into another, the light waves change speed and direction.

13. Refraction is the change in direction of light waves when they travel from one material to another material.

14. The greater the change in speed is, the more the light wave changes direction.

Discussion Question

Think of three different materials—one transparent, one translucent, and one opaque. What happens when light comes in contact with each material?

An example of a transparent material is clear glass; when light comes in contact with glass, it transmits the light waves, and objects can be seen clearly through the glass. An example of a translucent material is glass brick; it transmits light waves, but objects cannot be seen clearly through it. An example of an opaque material is black cloth; light waves cannot travel through the material.

Lesson Outline for Teaching

Lesson 3: Mirrors, Lenses, and the Eye

A. Why are some surfaces mirrors?

1. A smooth surface reflects light rays traveling in the same direction at the same angle; this is called regular reflection.
2. When a surface is not smooth, the reflected light rays travel in many different directions; this is called diffuse reflection.

B. Types of Mirrors

1. Any reflecting surface is a(n) mirror.
2. The shape of a mirror's surface affects how the image appears in that mirror.
3. A(n) plane mirror is a flat reflecting surface. The image is right-side up and reversed left to right.
4. A(n) concave mirror has a reflecting surface that curves inward. Parallel light rays reflect through one focal point.
5. If an object is closer than one focal length from a concave mirror, the image of that object will be right-side up. If the object is more than one focal length from a concave mirror, the image will be upside down.
6. A(n) convex mirror has a reflecting surface that curves outward. Images in this kind of mirror are always right-side up and smaller than the original object.

C. Types of Lenses

1. A transparent object with at least one curved side that causes light to change direction is called a(n) lens.
2. A(n) convex lens curves outward on one side.
3. Like a concave lens, a convex lens has a(n) focal point and a focal length. When an object is less than one focal length from a convex lens, the image appears larger and right-side up.
4. A concave lens is curved inward on one side.
5. The image formed by a concave lens appears to be upright, smaller, and closer to the lens than the original object.

D. Light and the Human Eye

1. The cornea is the first part of your eye that light rays travel through. It is a(n) convex lens made of transparent tissue.
2. The iris controls the amount of light entering the eye; the pupil is an opening that leads to the inside of your eye.
   - **a.** In bright light, the iris relaxes, and the pupil becomes smaller.
   - **b.** In dim light, the iris contracts, and the pupil becomes larger.

3. Behind your iris is the lens, which is transparent tissue that helps focus an object.
4. The back of the eye has a layer of light-sensitive cells called the retina; images form on this layer.
   a. Rod cells in the retina fire when the levels of light are low.
   b. Cone cells in the retina fire when light levels are high. Three types of these cells are sensitive to different wavelengths of light, allowing us to see colors.

E. The Colors of Objects

1. The colors of an object depend on the wavelength of the light waves it reflects.
   a. When light waves of different wavelengths interact with an object, the object absorbs some light waves and reflects others. The wavelengths of light waves absorbed and reflected depend on the materials from which the object is made.
   b. When reflected light comes in contact with your eye, the cone cells in your retina send nerve signals to your brain.
2. The color that an object appears to be depends, in part, on the color of the light shining on it.
3. White light is a combination of light of many different colors.

Discussion Question

Compare and contrast plain, convex, and concave mirrors.

All three types of mirrors reflect an image. Plain mirrors reflect the image so that it is the same size but reversed from left to right; convex mirrors reflect an image that is right-side up and smaller than the original object; concave mirrors reflect the image upside down if the object is farther than the focal length; they reflect the image small and right-side up if the object is closer than the focal length; at the focal length, the image disappears completely.