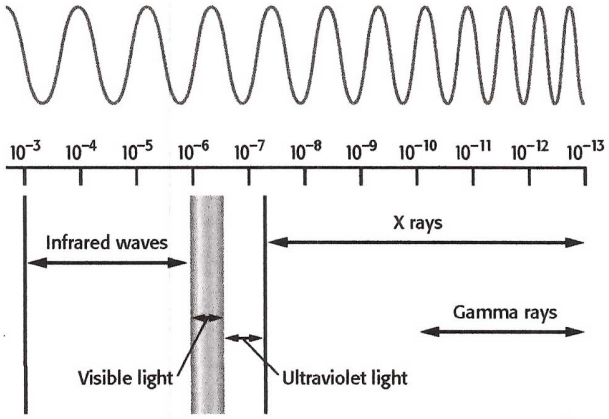
S8P4.a Identify the characteristics of electromagnetic and mechanical waves.

STANDARD REVIEW

Electromagnetic waves, such as light, and mechanical waves, such as sound, both transmit energy from one place to another, and they both interact with objects when they strike them. The two kinds of waves are different in some ways. Mechanical waves need a medium to carry their energy but electromagnetic waves do not, so they can travel in a vacuum. Also, electromagnetic waves behave as particles in some circumstances but mechanical waves do not.

Waves transfer energy as they travel, and waves can do work. The energy of mechanical waves is carried by vibrations, which are movements of the particles that transmit the waves from one place to another. The energy of an electromagnetic wave is carried by the interaction of magnetic and electrical forces. The amount of energy carried by a wave is related to its frequency (the number of cycles in a period of time) and to the wavelength (distance from crest to crest of the wave). For a particular type of wave, an increase in frequency increases the amount of energy that the wave carries. Since an increase in the frequency of waves also means a decrease in the wavelength of waves (less distance from crest to crest, therefore shorter waves), you can see that the shorter the wave, the more energy it carries.



STANDARD PRACTICE

Directions Using the Standard Review and what you have studied, read each question and circle the letter of the best response. Use a separate sheet of paper to record your response to open-response questions.

1. **A wave is a disturbance that transmits**

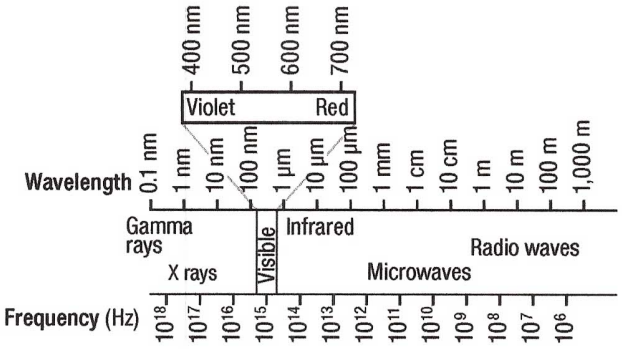
   A. matter.

   B. particles.

   C. energy.

   D. a medium.

2. **Use the illustration below to answer the following question**



   Microwaves are higher in energy than

   A. radio waves.

   B. visible light.

   C. gamma rays.

   D. X rays.

3. **Waves that don't require a medium are**

   A. longitudinal waves.

   B. electromagnetic waves.

   C. surface waves.

   D. mechanical waves.

4. **Sometimes, people at a sports event do "the wave." Is this a real example of a wave? Why or why not?**

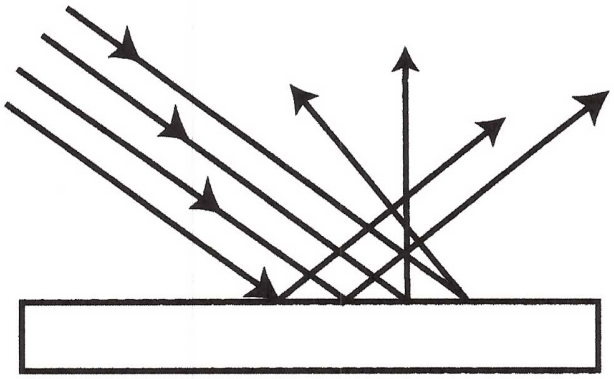
5. **The earth receives electromagnetic waves from space every day. What is the source of those waves?**

S8P4.b Describe how the behavior of light waves is **manipulated** causing reflection, refraction, diffraction, and absorption.

STANDARD REVIEW

When light hits any form of matter, the light can interact with the matter in different ways. The light can be reflected, absorbed, or transmitted. You know that reflection happens when light bounces off an object. Reflected light allows you to see things. And you know that absorption is the transfer of light energy to matter. Absorbed light can make things feel warmer. Transmission is the passing of light through matter. In fact, without the transmission of light, you couldn't see. All of the light that reaches your eyes is transmitted through air and through several parts of your eyes. Light can interact with matter in several ways at once.

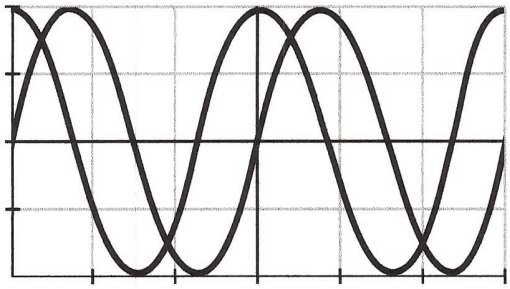
Light waves change when they hit materials. The way light waves change depends on the material the waves hit. How do changes in light waves cause reflection, refraction, diffraction, and absorption? When waves encounter objects, they interact with these objects by changing direction or amplitude. Reflection occurs when a wave strikes an object and bounces back. Diffraction occurs when a wave bends as it passes an edge. Refraction is a bending of a wave when it passes between one medium and another and its speed changes. Interference is the interaction of two similar waves when they pass through the same space.



STANDARD PRACTICE

Directions Using the Standard Review and what you have studied, read each question and circle the letter of the best response. Use a separate sheet of paper to record your response to open-response questions.

1. **Use the illustration below to answer the following question.**



If these waves interfere with each other, what will result?

A. constructive interference

B. destructive interference

C. constructive interference in some places and destructive interference in others

D. neither constructive nor destructive interference

2. **The bending of a wave as it passes at an angle from one medium to another is called**

A. reflection. **B.** refraction.

C. diffraction. **D.** interference.

3. **The color of an opaque object is determined by the**

A. the colors of light that are reflected.

B. the colors of light that are diffracted.

C. the colors of light that are transmitted.

D. the colors of light that are refracted.

4. **Explain why a prism causes sunlight to appear as a rainbow.**

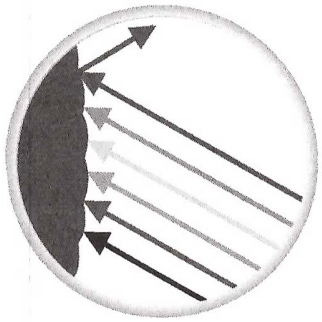
5. **What is the relationship between frequency, wave speed, and wavelength?**

S8P4.c Explain how the human eye sees objects and colors in terms of wavelengths.

STANDARD REVIEW

Explain that light waves with different properties are detected by the human eye as different colors. Some of the energy that reaches Earth from the sun is visible light. The visible light from the sun is white light. White light is visible light of all wavelengths combined. Light from lamps in your home as well as from the fluorescent bulbs in your school is also white light. Cells in the human eye react differently to different wavelengths of light. As a result, humans see the different wavelengths of visible light as different colors.

The longest wavelengths are seen as red light. The shortest wavelengths are seen as violet light. The range of colors is called the visible spectrum. To help you remember the colors, you can use the name ROY G. BiV. The capital letters in Roy's name represent the first letter of each color of visible light: red, orange, yellow, green, blue, and violet. You can think of "i" in Roy's last name as standing for the color indigo. Indigo is a dark blue color. Though the colors are given separate names, the visible spectrum is a continuous band of colors.



STANDARD PRACTICE

Directions Using the Standard Review and what you have studied, read each question and circle the letter of the best response. Use a separate sheet of paper to record your response to open-response questions.

1. **Which of the following colors of light has the shortest wavelength?**

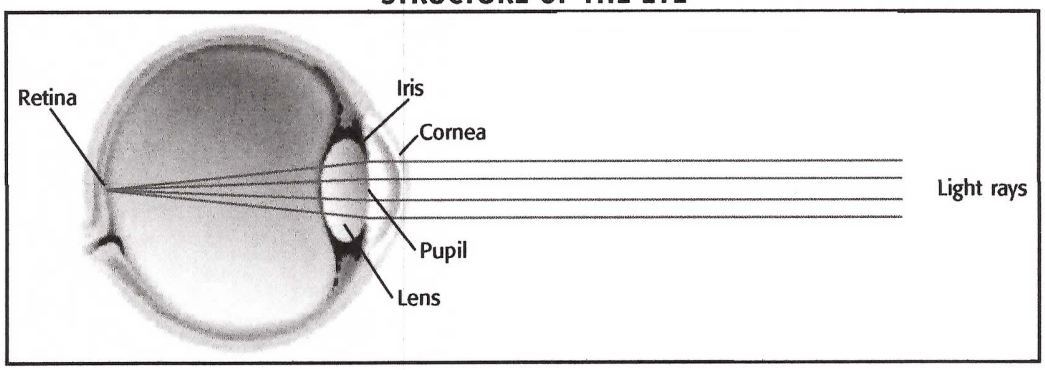
   A. red

   B. yellow

   C. blue

   D. violet

STRUCTURE OF THE EYE



2. **The correct sequence for structures that light passes through when entering the eye, from outside to inside, is**

   A. cornea, retina, lens.

   B. retina, cornea, pupil.

   C. cornea, pupil, lens.

   D. pupil, optic nerve, retina.

3. **Which light interaction explains why you can see things that do not produce their own light?**

   A. absorption

   B. reflection

   C. refraction

   D. scattering

4. **Why do you think color deficiency cannot be corrected?**

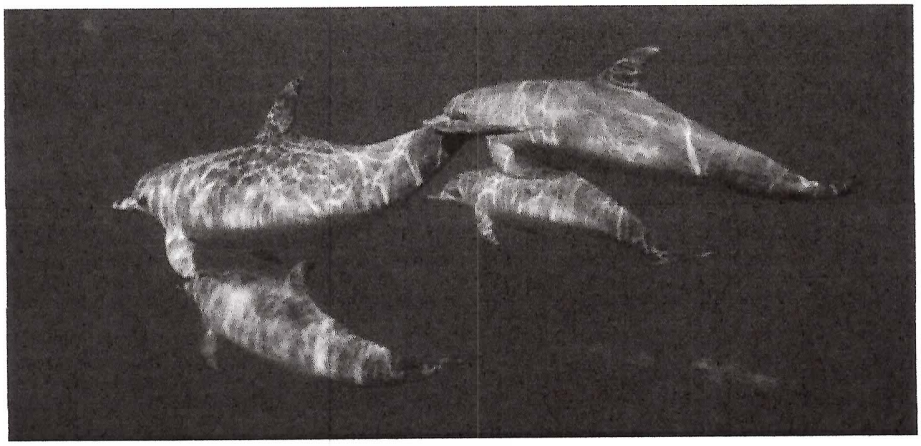
5. **Would you have surgical eye correction? Explain your reasons.**

S8P4.d Describe how the behavior of waves is **affected** by medium (such as air, water, solids).

STANDARD REVIEW

Have you ever seen a cat's eyes glow in the dark when light shines on them? Cats have a special layer of cells in the back of their eyes that reflects light. This layer helps the cat see better by giving the eyes a second chance to detect the light. Reflection is one interaction of light waves with matter. Light travels in straight lines as long as the material that the light travels through doesn't change. So, a ray of light shining through air is usually straight. One way to change the direction of a light beam is by reflection. Reflection is the bouncing back of light rays when they hit an object. But light doesn't change directions randomly. Instead, it follows the law of reflection.

A wave is a disturbance in space that transfers energy from one place to another. There are many types of waves that travel through water, air, Earth, and even space. There are some properties that all waves have in common that can be used to explain how waves transfer energy. Think about how waves behave differently as they pass through different solids, through liquids (such as water), and through gases (such as air).



STANDARD PRACTICE

Directions Using the Standard Review and what you have studied, read each question and circle the letter of the best response. Use a separate sheet of paper to record your response to open-response questions.

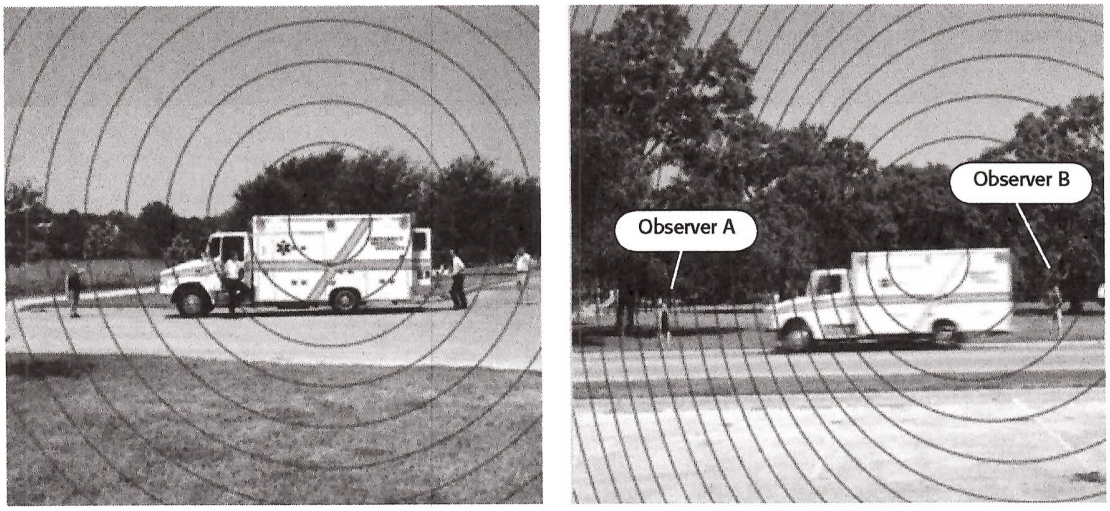
S8P4.e Relate the properties of sound to everyday experiences.

STANDARD REVIEW

Explain how sound affects your everyday life. As different as they are, all sounds have some things in common. One characteristic of sound is that it is created by vibrations. A vibration is the complete back-and-forth motion of an object. All sounds are generated by vibrations. Sounds travel as longitudinal waves consisting of compressions and rarefactions. Sound waves travel in all directions away from their source. Sound waves require a medium through which to travel. Sound cannot travel in a vacuum. Your ears convert sound into electrical impulses that are sent to your brain. Exposure to loud sounds can cause hearing damage. Using earplugs and lowering the volume of sounds can prevent hearing damage.

The Doppler effect is a change in frequency of a wave caused by the motion of the source of the wave. An example of the Doppler effect is the sound of a siren on a fire engine. As the fire engine moves toward you, the sound has a higher frequency because each wave starts from a place closer to you than the previous wave. After the fire engine passes, each wave starts from a point farther away than the previous wave, so the sound has a lower frequency. You can hear the change in frequency as the fire engine passes.

The Doppler Effect



STANDARD PRACTICE

Directions Using the Standard Review and what you have studied, read each question and circle the letter of the best response. Use a separate sheet of paper to record your response to open-response questions.

1. **When a race car on a track passes an observer, the frequency of the sound of its engine changes because**

   A. the speed of the car changes as it passes.

   B. the density of the air changes as the car moves through it.

   C. the sound that the engine makes is constantly changing.

   D. each wave crest begins at a different place.

2. **If a fire engine is traveling toward you, the Doppler effect will cause the siren to sound**

   A. higher.

   B. lower.

   C. louder.

   D. softer.

3. **Sound travels fastest through**

   A. a vacuum.

   B. air.

   C. sea water.

   D. glass.

4. **Describe how the Doppler effect helps a beluga whale determine whether a fish is moving away from it or toward it.**

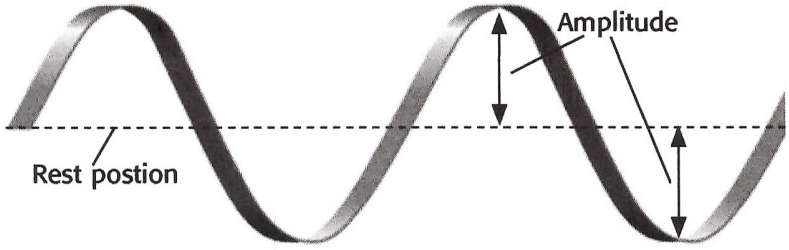
5. **How do vibrations cause sound waves?**

S8P4.f Diagram the parts of the wave and explain how the parts are affected by changes in amplitude and pitch.

STANDARD REVIEW

Amplitude is the maximum distance the particles of a medium vibrate from their rest position. A wavelength is the distance between two adjacent corresponding parts of a wave. Frequency is the number of waves that pass a given point in a given amount of time.

Three of the basic properties of a wave are related to one another in the wave equation—wave speed, frequency, and wavelength. If you know any two of these properties of a wave, you can use the wave equation to find the third. One of the things the wave equation tells you is the relationship between frequency and wavelength. If a wave is traveling at a certain speed and you double its frequency, its wavelength will be cut in half. Or if you were to cut its frequency in half, the wavelength would be double what it was before. So, you can say that frequency and wavelength are inversely related. Think of a sound wave, traveling underwater at 1,440 m/s, given off by the sonar of a submarine. If the sound wave has a frequency of 360 Hz, it will have a wavelength of 4.0 m. If the sound wave has twice that frequency, the wavelength will be 2.0 m, half as big. The wave speed of a wave in a certain medium is the same no matter what the wavelength is. So, the wavelength and frequency of a wave depend on the wave speed, not the other way around.



STANDARD PRACTICE

Directions Using the Standard Review and what you have studied, read each question and circle the letter of the best response. Use a separate sheet of paper to record your response to open-response questions.

1. **As the wavelength increases, the frequency**

   A. decreases.

   B. increases.

   C. remains the same.

   D. increases and then decreases.

2. **The energy of a photon is proportional to**

   A. the amplitude of a wave.

   B. the wavelength of a wave.

   C. the frequency of a wave.

   D. the speed of light.

3. **Which of the following results in more energy in a wave?**

   A. a smaller wavelength

   B. a lower frequency

   C. a shallower amplitude

   D. a lower speed

4. **Draw a transverse wave and a longitudinal wave. Label a crest, a trough, a compression, a rarefaction, and wavelengths. Also, label the amplitude on the transverse wave.**

5. **Explain how you could change the pitch and frequency of the sound from a guitar.**

S8P5.a Recognize that every object exerts gravitational force on every other object and that the force exerted depends on how much mass the objects have and how far apart they are.

STANDARD REVIEW

Know that every object pulls on every other object in the universe. The strength of that pull depends on the mass of the objects and how far apart the objects are. The mass of an object is a measure of the amount of matter it contains, so mass is a constant characteristic of a particular object. Weight is a measure of the force of gravity on the object, which is proportional to the mass. Therefore, weight is a function of the masses of the object and the larger object to which it is attracted, so weight can vary. A person would not weigh as much on the moon as on Earth.

Gravity is a force of attraction between objects. When you see or hear the word weight, it usually refers to Earth's gravitational force on an object. But weight can also be a measure of the gravitational force exerted on objects by the moon or other planets. Weight is related to mass, but they are not the same. Weight changes when gravitational force changes. Mass is the amount of matter in an object. An object's mass does not change. Imagine that an object is moved to a place that has a greater gravitational force—such as the planet Jupiter. The object's weight will increase, but its mass will remain the same.

STANDARD PRACTICE

Directions Using the Standard Review and what you have studied, read each question and circle the letter of the best response. Use a separate sheet of paper to record your response to open-response questions.

1. **When a soccer ball is kicked, the action and reaction forces do not cancel each other out because**

   A. the forces are not equal in size.

   B. the forces act on different objects.

   C. the forces act at different times.

   D. all of the above

2. **Which of the following is in projectile motion?**

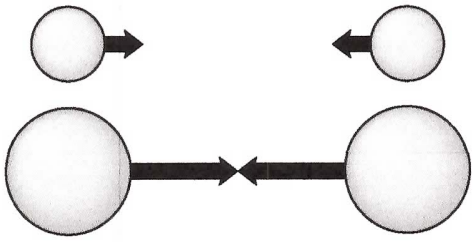
   A. a feather falling in a vacuum

   B. a cat leaping on a toy

   C. a car driving up a hill

   D. a book lying on a desk

3. **Use the following illustration to answer the question below.**



How Mass Affects Gravitational Force

Gravity is a force that acts at a distance between objects. The mass of objects affects gravitational force. The length of the arrows indicates the size of the gravitational force. The larger spheres represent objects with larger masses. How does mass affect gravitational force?

A. The gravitational force between objects decreases as the masses of the objects increase.

B. The gravitational force between objects increases as the masses of the objects increase.

C. The gravitational force between objects increases as the masses of the objects decrease.

D. The gravitational force between objects increases even when the masses of the objects remain the same.

4. **How is the acceleration of falling objects affected by gravity?**

5. **Why is the acceleration due to gravity the same for all objects?**

S8P5.b Demonstrate the advantages and disadvantages of series and parallel circuits and how they **transfer** energy.

STANDARD REVIEW

A series circuit is a circuit in which all parts are connected in a single loop. There is only one path for charges to follow, so the charges moving through a series circuit must flow through each part of the circuit. All of the loads in a series circuit share the same current.

If there is any break in the circuit, the charges will stop flowing. For example, if one light bulb in a series circuit burns out, there is a break in the circuit. None of the light bulbs in the circuit will light. Using series circuits would not be a very convenient way to wire your home. Imagine if your refrigerator and a lamp were in a series circuit together. Your refrigerator would run only when the lamp was on. And when the bulb burned out, the refrigerator would stop working!

But series circuits are useful in some ways. For example, series circuits are useful in wiring burglar alarms. If any part of the circuit in a burglar alarm fails, there will be no current in the system. The lack of current signals that a problem exists, and the alarm will sound. Think about what would happen if all of the lights in your home were connected in series. If you needed to turn on a light in your room, all other lights in the house would have to be turned on, too! Instead of being wired in series, circuits in buildings are wired in parallel. A parallel circuit is a circuit in which loads are connected side by side. Charges in a parallel circuit have more than one path on which they can travel. Unlike the loads in a series circuit, the loads in a parallel circuit do not have the same current. Instead, each load in a parallel circuit uses the same voltage.

You can connect loads that need different currents to the same parallel circuit. For example, you can connect a hair dryer, which needs a high current to run, to the same circuit as a lamp, which needs less current. In a parallel circuit, each branch of the circuit can work by itself. If one load is broken or missing, charges will still run through the other branches. So, the loads on those branches will keep working. In your home, each electrical outlet is usually on its own branch and has its own switch.