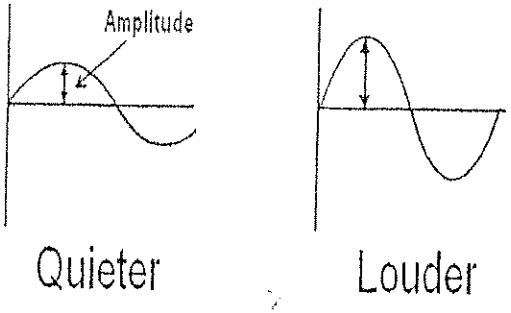
Name _____

TEXT IN THE MIDDLE

Guided Highlighted Reading	Text	Diagram/Picture or Question
1) List the characteristics of all waves:	**2. Characteristics of Waves** You just learned that there are many different kinds of waves. Sound waves, light waves, x-rays, microwaves, and ocean waves, seismic waves are but a few examples. All waves, however, share certain basic characteristics. All waves have amplitude, wavelength and frequency. In order to understand these characteristics of waves, it may help you to represent a wave as a drawing on a graph. The x-axis (horizontal line) represents the normal, or resting, position of the medium or field, before it is disturbed by a wave. For example, the x-axis might represent a calm sea or a tight rope. The vibrational movements of the wave are shown on the y-axis (the vertical line). The highest points on the graph are called crests. The lowest points are called troughs (trawfs).	(2nd paragraph) Draw a graph. Label the x-axis, rest. Label the y-axis, vibrations. Draw a wavy line through the x-axis on your graph that has a regular repeating pattern. Be sure the wavy line goes above and below the x-axis (resting position) Label the crests and troughs.
2) Find and highlight the definition of amplitude.	**Amplitude** If the wave disturbs a medium, the particles of the medium are moved from their normal (resting) position. The distance the particles are moved from their resting position is shown by the up and down pattern of the graph. Similarly, if the wave disturbs electric or magnetic fields, the graph shows the rise and fall of the fields. In any wave, the amount of movement from rest is shown by the distance above or below the x-axis. The maximum (or greatest) movement from rest is called the amplitude (am-pluh-tood) of the wave. The amplitude can be found by measuring the distance from rest to a crest or from rest to a trough.	(3rd paragraph) Calculate the amplitude of these waves. Measure to the nearest mm.  Quieter Louder
3) How do you measure amplitude?		Quleter _____ dB Louder _____ dB dB stands for decibels, and it is the unit used for amplitude or loudness of the sound.

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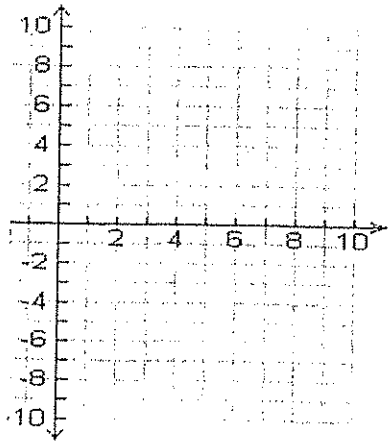
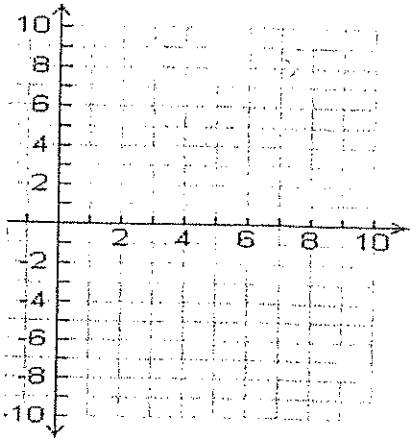
4) How is energy related to amplitude? 5) Energy and amplitude: Greater energy means _____ crests/troughs. Less energy means _____ crests/troughs.	The amplitude of a wave indicates the amount of energy carried by the wave. As energy increases, particles of the medium are moved a greater distance from rest. Thus the amplitude of the wave also increases. The amplitude decreases as the wave loses energy. What happens to the crests and troughs of waves as amplitude increases? As it decreases?	On the rest line below, draw a repeated pattern of a wave with small amplitude.  On the rest line below, draw a repeated pattern of a wave with greater amplitude. 

Name _____ TEXT IN THE MIDDLE

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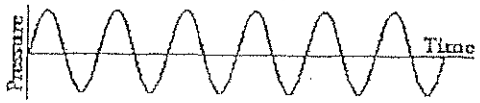
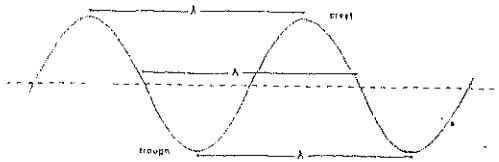
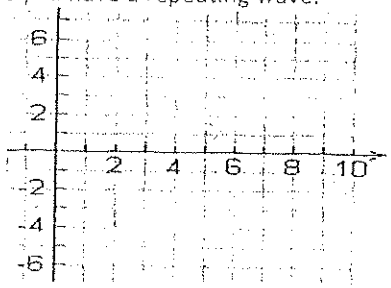
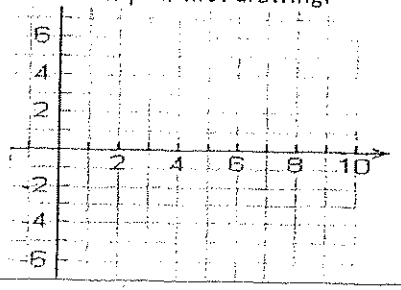
6) Find and highlight the word(s) that mean consecutive. 7) Define wavelength. 8) Where do you begin measuring the wavelength of a wave? Explain your reasoning. 9) Find and highlight what makes up a complete wave? 10) Highlight one complete wave.  a) How many complete waves are in this diagram? ____ b) If this diagram represented one second of time, what would the frequency be? _____ Hz c) If this diagram represented two second of time, what would the frequency be? _____ Hz **Review** 11) How are wavelength and frequency related?	Wavelength and Frequency **Wavelength** The distance between two consecutive, one after another, crests or troughs of a wave is the wavelength. Actually the wavelength can be measured from any point on a wave as long as it is measured to the same point on the next wave. Wavelength is usually measured in meters or centimeters. The symbol for wavelength is the Greek letter lambda. (λ) **Frequency** The number of complete waves, or complete cycles, per unit of time is called the frequency. Because every complete wave has one complete crest and one complete trough, you can think of the frequency as the number of crests or troughs produced per unit time. The unit used to measure wave frequency is called the Hertz (Hz). This unit is named after Heinrich Hertz, who was one of the first scientists to study certain types of waves. A frequency of 1 Hz is equal to one wave, or cycle, per second: 1 Hz = 1 wave/second. The frequency of a wave depends on the frequency at which the source is vibrating. Think about the rope again. If you move your hand slowly, the rope vibrates slowly. Perhaps you'll create one new waves every two or three seconds. If you move your hand rapidly, the rope vibrates rapidly. This way, you may create several waves each second. Try it in and see! Frequency, which is often used to describe waves, is an important characteristic. Frequency is used to distinguish one color of light from another, as well as one sound from another. For example, red light is different from blue light because red light has a lower frequency. A dog can hear a whistle that you cannot hear because dogs can hear sounds at higher frequencies than humans can.	**Wavelength** Color blue the **beginning** and **ending** point of one wavelength.  Color green, the **beginning** and **ending** point of another wavelength. **Frequency** On the graph below, draw a low frequency wave. Be sure you have a repeating wave.  Now draw a higher frequency wave. Be sure you have a repeating pattern **and that the amplitude is the same as in your first drawing.** 

Name _____ TEXT IN THE MIDDLE

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1) Find and highlight how ocean and sound waves are alike. 2) Waves are classified as transverse or longitudinal based on two things. List the two things you need to know to classify a wave as transverse or longitudinal. a) b)	**3. Types of Waves** You learn that mechanical waves require a medium through which to travel. Although they share this characteristic, all mechanical waves are not the same. Ocean waves are a different type of wave from sound waves. Why? Although they transfer energy through a medium, the movement of the disturbance, or wave, through the medium is quite different. Depending on the motion of the medium as compared to the movement of the wave, waves are classified as either transverse or longitudinal. **Transverse Waves** When one end of the rope is jerked, energy is given to the nearby particles of rope. These particles start to move up and down (vertically) as a result of the energy. As they move, they transfer energy to neighboring particles, which in turn move up and down. As each neighboring rope particle begins to move up and down, energy is transferred from one place to another (horizontally). Each particle moves up and down, but the wave moves horizontally along the rope. Thus the movement of the particles is vertical while the movement of the waves is horizontal. The two movements are at right angles to each other. A wave in which the motion of the medium is at right angles to the direction of the wave is called a transverse wave. A wave on a rope is a transverse wave. Light and other electromagnetic waves are transverse waves. **Longitudinal Waves** Clap your hands together near your face. Do you hear a clap? Do you also feel air striking your face? When you clap your hands, you move the particles of air away from their resting positions and crowd them together. A space in the medium in which the particles are crowded together is called a compression. Because you give the particles energy, they begin to vibrate back and forth. As the particles of air move to the right, they pass their resting positions and collide with the particles of air next to them. These particles also become compressed. Then the first set of air particles moves to the left and the second set of particles begins to vibrate and	<u>Slinky Demonstration</u> **Draw a model of a transverse wave.** Use an arrow to show the motion of the energy and label the arrow "energy". Draw another arrow to show the motion of the particles and label this arrow "particles".

3) Comparing longitudinal and transverse waves: List some ways they are alike:

4) Contrasting longitudinal and transverse waves: List some ways they are different:

5) List whether these energy waves are transverse, longitudinal or a combination.

light _____

sound _____

water _____

x-rays _____

microwaves _____

moves to the right. This leaves a space that contains many fewer particles. A space in the medium in which there are fewer particles is called a rarefaction (rair-uh-fak-shuhn).

Each layer of particles pushes the next layer as the compressions move forward through the medium. Each compression is followed by a rarefaction. So rarefactions also move forward. As the layers of particles move back and forth through a medium, compressions and rarefactions develop and move in a regular, repeating way. Energy is transmitted as a wave. A wave that consists of a series of compressions and rarefactions is a longitudinal wave.

As you can see, longitudinal waves are quite different from transverse waves. In a longitudinal wave, the motion of the medium is parallel to the direction of the wave. In other words, the particles of the medium move in the same direction in which the wave moves. Sound waves are longitudinal waves.

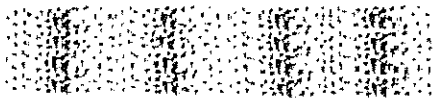
Longitudinal waves can be represented on a graph in the same way transverse waves can. The crests represent the crowded areas, or compressions. The troughs represent the least crowded areas, or rarefactions. The wavelength of a longitudinal wave is the distance between compressions or rarefactions. Frequency is the number of compressions or rarefactions that pass a point per second.

Combination Waves

Some waves cannot be described as only transverse or longitudinal. That's because these waves are a combination of the two types of waves. An example of such a wave is a surface wave. Surface waves, as their name implies, occur at the surface between two different mediums. Water waves on the surface of the ocean are an example of surface waves. They travel between water and air. The motion of each particle is neither up and down nor back and forth. It is a combination of both movements. The combination produces a wave in which each particle moves in a circle.

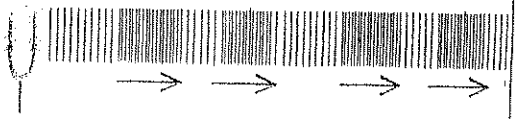
Both models below represent longitudinal waves.

Label the compressions and rarefactions of the wave below.

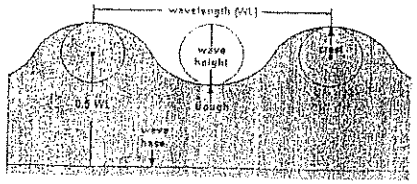


What is this wave's wavelength? _____
Include the correct unit for wavelength.

What is this wave's frequency? _____
Include the correct unit for frequency.



Surface Waves



Water waves

Earthquake waves

Name _____	TEXT IN THE MIDDLE	
Guided Highlighted Reading	Text	Diagram/Picture or Question
	Geophysicist Scientists who study and map out the Earth's layers and discover its treasures are called geophysicist. A common technique used by geophysicists is to send sound waves downward through rock. The sound waves are reflected from the rock layers back to the surface. By recording the time it takes for the waves to travel through the various regions, geophysicists can determine the components of the rock layers. A college degree in geology is required to become a geophysicist. For more information, contact the: American Geophysical Union Meetings and Members Program 2000 Florida Avenue, NW Washington, DC 20009	