COLLETTE YOUNG

Science Through the Artist's Perspective

SESSION FIVE

SOUND AND WAVES ACTIVITY HANDOUTS

DO NOW *Predict some instruments in an orchestra.*

ACTIVITY

This is an activity in which you will have several minutes to collect data on what you see and the sounds you hear.

INSTRUMENT

1. DESCRIBE THE SOUND YOU HEAR. HOW DOES IT COMPARE WITH OTHER SOUNDS YOU HAVE HEARD?

2. SKETCH AND DESCRIBE THE INSTRUMENT BELOW

3. HOW DO YOU THINK THE STRUCTURES IN THE INSTRUMENT AFFECT THE SOUND (ITS FUNCTION)?

4. WHAT QUESTIONS DO YOU HAVE ABOUT WHY THIS PHENOMENON HAPPENED?

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READINGS FROM

"CONCEPTS AND CHALLENGES IN PHYSICAL SCIENCE"

Leonard Bernstein, Martin Schachter, Alan Winkler, Stanley Wolfe

WHAT IS A WAVE?

WAVE AND ENERGY

Have you ever seen ocean waves crashing on the coastline? Waves are disturbances that transfer energy from one place to place. Ocean waves carry energy along the surface of the water. Where does the energy come from? The energy of ocean waves comes from wind moving over the water. Throw a stone into a still pond. What do you see? Small circular waves move outward along the surface of the pond. When the stone hits the pond, it has kinetic energy. Kinetic energy is energy of motion. Some of the stone's kinetic energy is transmitted to the water particles. The energy causes the particles to move. This movement produces a wave. The wave carries the energy across the surface of the pond.

ENERGY AND MATTER

Water is a medium for waves. Any substance through which waves can travel is a medium. Air is a medium for sound waves. Some waves do not need a medium. Light waves can travel through the vacuum of space. When a wave travels through a medium, only energy moves from place to place. The particles of the medium do not move forward with the wave. Think of a cork floating on water. What happens as a wave moves past the cork? The cork moves up and down. It does not move in the same direction as water. The wave moves through the water.

PARTICLES IN A MEDIUM

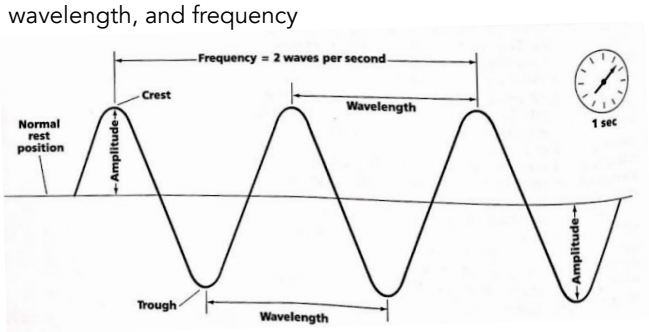
When a wave moves through a medium, the particles of the medium move in small circles. The diagram shows a wave moving through water. As the wave goes past, each water particle moves in a small circle. This is why a floating cork bobs up and down as a wave passes. The energy of the wave moves forward. The water does not move forward.

WHAT ARE THE FEATURES OF A WAVE?

FEATURES OF WAVE

All waves have three basic features. These features are amplitude, wavelength, and frequency.

- When a wave moves through a medium, the particles of the medium are moved from their rest position. The distance the particles are moved is called the amplitude or height of the wave.
- All waves have a certain length. The distance from the crest or trough of one wave to the crest or trough of the next wave is the wavelength. Wavelength can be measured in meters or centimeters.
- A certain number of waves pass a point in a given amount of time. The number of complete waves per unit time is called the frequency. Frequency is measured in waves per second.
- The diagram shows the relationship among amplitude, wavelength, and frequency



SPEED OF WAVE

All waves move at a certain speed. The speed of a wave is related to the frequency and wavelength of the wave. Wave speed is equal to the frequency times the wavelength. Speed = frequency x wavelength. Scientists use a unit called a hertz to measure frequency. One hertz is equal to one wave per second. When frequency is measured in hertz and wavelength is measured in meters, speed is measured in meters per second (m/sec).

HOW ARE WAVES REFLECTED?

WAVES AND BARRIERS

What happens when a wave hits a barrier? Remember that all waves carry energy. Some of the wave's energy may be absorbed by the barrier. If the barrier does not absorb the wave's energy, the wave bounces back from the barrier. This bouncing back of a wave is called reflection.

REFLECTION

Figure 2 shows what happens when a wave strikes a barrier. The arrows show the direction of the wave. The wave that strikes the barrier is called the incident wave. The wave that bounces off the barrier is called the reflected wave.

LAW OF REFLECTION

The law of reflection describes what happens when a wave is reflected from a barrier. The angel at which an incident waves strikes a barrier is called the angle of incidence, or i. The angle at which the wave is reflected is called the angle of reflection, or r. These angles are measured form a line called the normal. The normal is a line at a right angle to the barrier. A right angle is equal to 90°. The law of reflection states that the angle of incidence is equal to the angle of reflection. Suppose a wave strikes a barrier at a 45° angle. The reflected wave will bounce back from the barrier at a 45° angle.

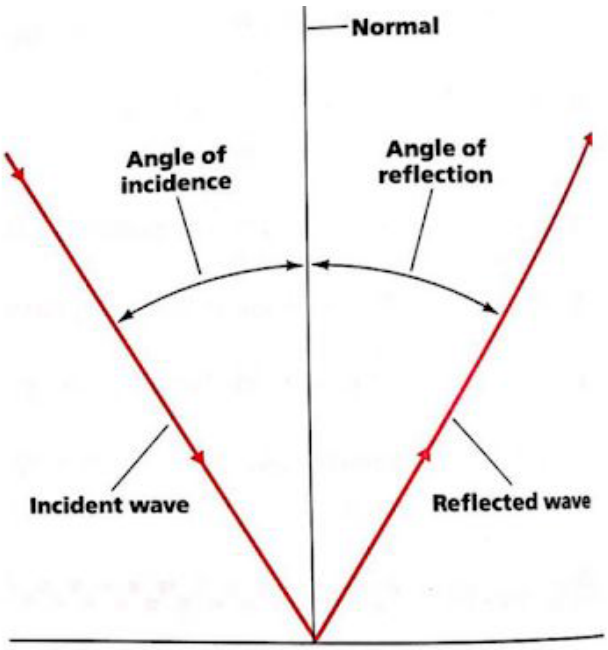


Figure 2
Angle of incidence = Angle of reflection