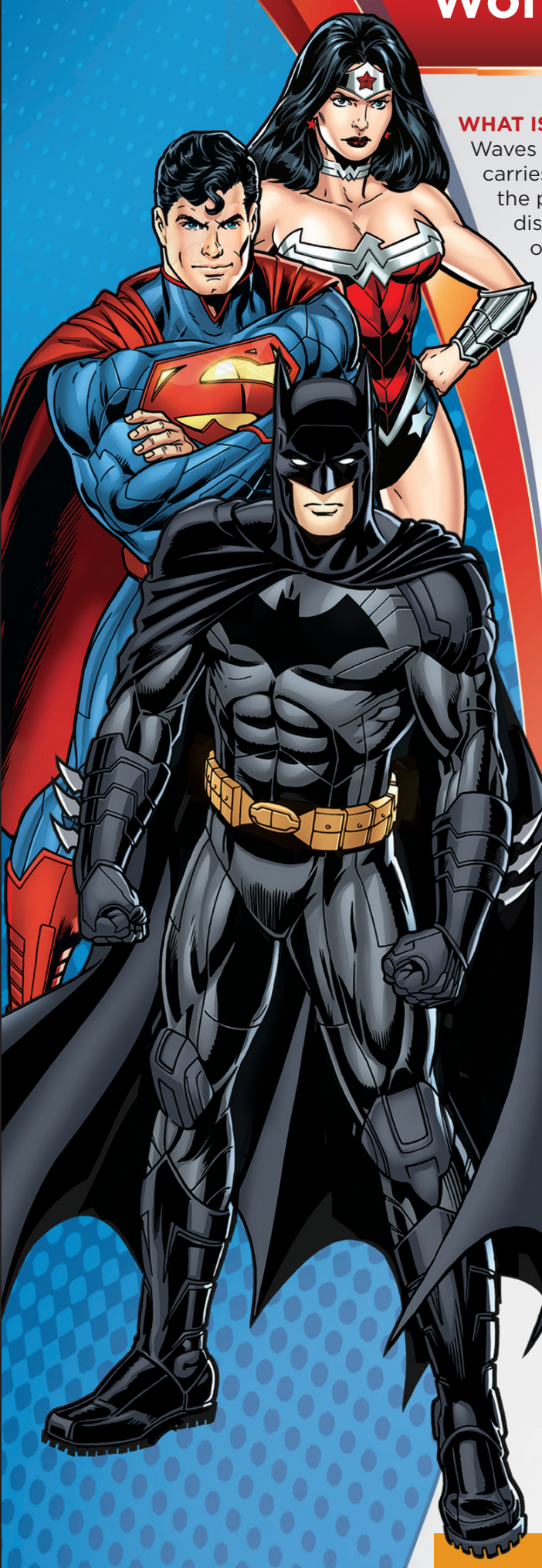
Newspapers In Education and the Washington State Fair present

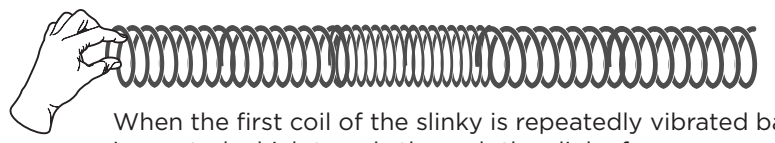
Wondrous Waves



WHAT IS A WAVE?

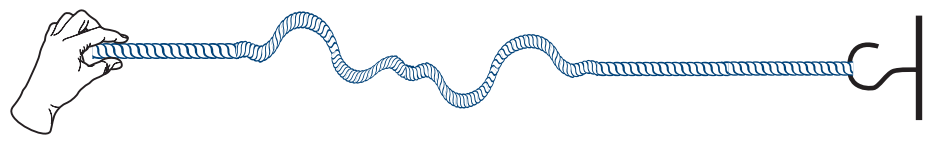
Waves are generally considered to be disturbances in a **medium** (the substance or material that carries a wave), such as when you throw something into a pond and it makes ripples. Waves disrupt the particles (or what the medium is made of) to transfer energy from place to place. After the disruption, the medium will return to its natural state — just like how water will return to the ocean after a wave has crashed.

When a slinky is stretched, the individual coils assume an equilibrium or rest position.



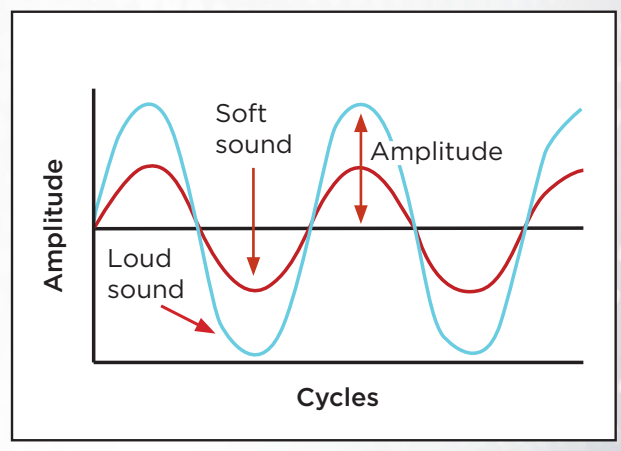
When the first coil of the slinky is repeatedly vibrated back and forth, a disturbance is created which travels through the slinky from one end to the other.

The same goes for this vibrating rope, the energy of the wave travels down the rope.



SOUND WAVES

Sound travels in waves. A sound wave is a mechanical wave created by a vibrating object. Sound waves travel through solids, liquids and gases, and transport energy from one location to another. The vibrating object that is the source of the sound could be a person's vocal cords (like Rachel Platten as she sings on stage), a string on an instrument or the vibrating tines of a tuning fork. A sound wave is made up of different properties including frequency, wavelength and amplitude.



Frequency is the number of waves passing a point in a given time, or how fast the wave vibrates. The frequency of a wave is measured as the number of complete back-and-forth vibrations. It is measured in hertz.

1 hertz = 1 vibration / second

Frequency corresponds to **pitch**. When a sound wave has a higher frequency, we hear it as a higher pitch. In percussion instruments, such as those used by Street Beat at the Washington State Fair, pitch can be altered a number of ways. Vibrations on bigger percussion instruments tend to vibrate less quickly, creating longer frequency waves that make a lower sound.

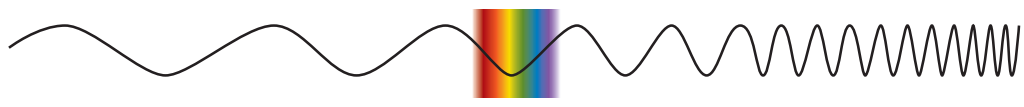
Amplitude is the highest point of a vibration in a period of time. Measured from the position of equilibrium. Amplitude directly relates to the intensity of a sound wave; the greater the amplitude, the greater the intensity. If you are in the cow barn at the Washington State Fair, stop and listen to the different cows. When the cows moo quietly, the amplitude of the sound wave is smaller than when they moo loudly. Can you determine which cow's moo has the greatest amplitude?

Wavelength is the length of one complete wave cycle.

LIGHT WAVES

Light travels in electromagnetic waves, meaning it can travel through solids, liquids, gases and through a vacuum. The electromagnetic spectrum is the continuous range of wavelengths over which electromagnetic radiation extends. Our eyes can only detect a small section of this spectrum; the light we can see falls into the visible light portion of the spectrum. The range of light we can see falls between wavelengths of 780 nanometers and 390 nanometers. Isaac Newton did experiments using prisms that separated visible light into the many colors it is comprised of. Each color corresponds to a particular wavelength range.

The Electromagnetic Spectrum



	Radio	Microwave	Infrared	Visible	Ultraviolet	X-ray	Gamma Ray
Wavelength in meters	←1	1 to 10^{-3}	10^{-3} to 10^{-6}	$8x10^{-7}$ to $4x10^{-7}$	$3x10^{-7}$ to 10^{-8}	10^{-8} to 10^{-12}	10^{-12}→
About the size of	Buildings	Grains of sugar	Protozoans	Bacteria	Molecules	Atoms	Atomic nuclei

The color we can see with the longest wavelength is red. The color we can see with the shortest wavelength is violet.

You can remember the order of colors (from longest to shortest wavelength) as ROYGBIV. That stands for Red, Orange, Yellow, Green, Blue, Indigo and Violet.

While you are at the Washington State Fair, record items you see that are each of the colors (ROYGBIV). Try to find at least three items for each color.

WHAT ABOUT X-RAY VISION?

Many superheroes including Supergirl, Superman and Wonder Woman, have X-ray vision. X-rays are electromagnetic waves, just like light, but they have much shorter wavelengths. These shorter rays can travel more easily through different types of medium, and travel easily through skin but not as easily through bone. The waves that are reflected off the bone (and not the waves that travel through the skin) create an image. In order for X-ray vision to truly occur, superheroes would need to have a source of X-ray radiation.