**Science Reviewer**

**Waves**

* Any disturbance or oscillation that comes from a source.
* Can transport energy from one point to another.
* Waves carry energy.
* Some types of waves are: Electromagnetic Waves, Seismic Waves, and Water Waves.
* **Wave** - Vibration in space and time.
* When there is a disturbance travelling without a medium, a wave is produced.
* A wave transports energy from one point (source) to another point.
* There are waves that need a medium (ex. oil in a frying pan to transfer heat) to travel.
* **Wave Pulse** - Simple disturbance.
* **Wave Train** - Series of disturbances.
* **Wave Motion** - Energy propagation by means of the motion of waves caused by disturbance. And in wave motion, matter does not move.

**Types of Waves**

* Waves are classified into two types based on direction of movement of the particles.
* Can be transverse or longitudinal.
* **Transverse Waves** - When the direction of the particles is perpendicular to the direction of the wave propagation.
* **Longitudinal Waves** - When the direction of the particles parallel to the direction of the wave propagation.
* **Seismic Waves** - Waves caused by the vibrations earth, such as earthquakes.
* **Water Waves** – Most common type of wave, caused by the vibrations of water, being the basis of waves themselves.
* **Compression** – Are areas where the coils are closer together in a slinky.
* **Rarefaction** – Are areas where the coils are far apart in a slinky.

**Longitudinal Waves**:

* When the direction of the particles parallel to the direction of the wave propagation.
* Example of longitudinal waves are sound waves and the compression and rarefaction of a slinky.

**Transverse Waves**:

* When the direction of the particles is perpendicular to the direction of the wave propagation.
* Example of transverse waves are light waves and rope waves.

**Mechanical Waves:**

* Waves that that need a medium to propagate their energy.
* This type of wave requires the presence of matter to travel.
* Substances are required to carry and transfer from its source to another location.

**Electromagnetic Waves:**

* Produced from the movement of electrically charged particles.
* Do not need a medium to transfer energy.
* Meaning these types of waves can travel in a vacuum.
* Includes (Longest to shortest wavelength): Radio waves, microwaves, infrared waves, visible light, ultraviolet, x-rays, and gamma rays.

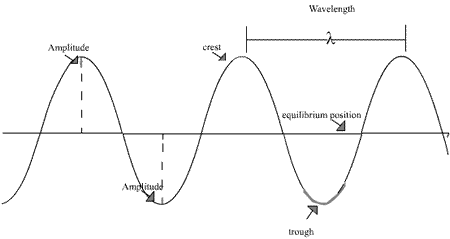
**Seismologists:**

* Uses knowledge and understanding about waves applying this in observation movements and vibrations on the ground.

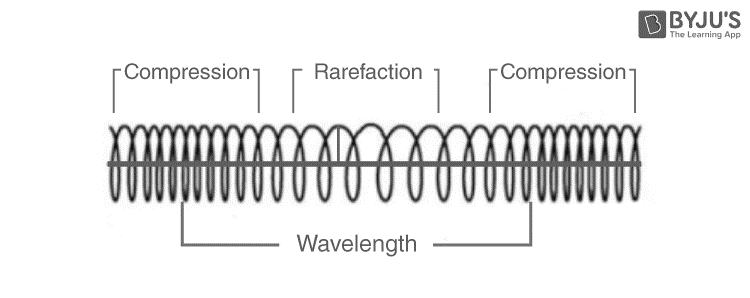
**Characteristics of Waves and Wave Velocity**

* As waves form, it eventually hits an endpoint.
* When the incident wave hits a boundary, some of it reflects.
* As light waves hit an object, they reflect in all directions and hits your eye.
* **Reflection** – Bouncing of waves when they hit a boundary.
* In wave motion, as a wave hit an obstacle, a portion gets reflected and another portion gets transmitted or absorbed.
* The wave velocity changes when hitting and causing a different direction when a boundary is being crossed by the waves.
* **Refraction** – Bending of waves as it encounters a change toward the waves when it moves through a different medium.
* **Diffraction** – As the waves travel, they spread along a certain space. The moment the waves hit an obstacle they bend.
* **Slits** – The obstacles causing the diffraction.
* **Interference** – Behavior of the waves as they pass through the same region of space at the same time.

**Wave Measurements:**



**Transverse Wave**



**Longitudinal Wave**

* **Crest** – Highest peak of a wave.
* **Trough** – Lowest point of a wave.
* **Velocity Propagation** – The velocity of the equilibrium.

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| **Wave Measurement** | **Definition** | **Symbol** |
| Amplitude | Maximum distance from the equilibrium position of the wave to the crease and the troughs. | A |
| Wavelength | Distance between two successive crests or troughs. | λ (Lambda) |
| Frequency | Number of cycles per unit of time. | f |
| Period | Time for one complete wavelength to pass by a given point. | T |

**Wave Velocity:**

* To determine the distance and the time it takes to travel and can distance.
* The distance moved by a wave in wavelength
* The time it takes to complete one wave cycle or wavelength period is written as:
* The wave velocity expressed in terms of frequency is:

**Waves or Particles**

* Electromagnetic radiation has properties of waves can also be thought as “stream of particles.”

**Electromagnetic Waves**

* Name for the range of electromagnetic waves when placed in order of frequency
* Highest to lowest frequency: Gamma Rays, X-rays, Ultraviolet Rays, Visible Light, Infrared Rays, Microwaves, Radio waves.
* Can travel 300,000 kilometers per second (speed of light).
* If the frequency gets higher, the wavelength gets shorter, and vice versa.
* Longest wavelengths, lowest frequencies.
* Ex. Light

**Light as a wave**: Behaves as a transverse wave which can be filtered using polarized lens.

**Light as a particle (Photon)**: When directed at a substance, light can knock electrons off a substance (Photoelectric effect).

* **Electromagnetic Wave** – When an electric field changes, so does the magnetic field.
* They travel as “vibrations in electrical and magnetic fields.”
* Have some magnetic and electrical properties.

**Radio Waves:**

* Longest wavelengths, lowest frequencies.
* **Global Positioning System (GPS)** – Measure the time it takes a radio wave to travel from several satellites to the receiver.
* A radio picks up radio waves through an antenna and converts it to sound waves.

**Sound Waves**

- Longitudinal waves created from a vibrating source.

- Requires a medium.

- Speed of sound is different in various materials.

- Sound waves travel more quickly in solids because the particles are more closely packed.

**Characteristics of Sound Waves**

**Pitch**

**Hertz (Hz):**

* Highness or lowness of sound.
* The frequency of a wave dictates the pitch of a sound.
* **Audible Frequencies** - 20 Hz to 20,000 Hz
* **Infrasonic Frequencies** - Below 20 Hz

**Loudness**

**Decibel (dB):**

* How soft or intense the sound is.
* Determined by the amplitude of the soundwaves.
* Decibel was made by Alexander Graham Bell.
* Considered as psychological sensation the differs for people.
* **Music** - Special sound that forms a pattern and is appealing to our sense of hearing.
* **Noise** - Distorted sound wave being unpleasant.
* **Human Hearing Range** - 0 dB - 120 dB
* **Threshold of Hearing** - 0 dB
* **Threshold of Pain** - 120 dB

**Timbre:**

* Tone quality.
* Differentiating two different sounds that have the same pitch and loudness.

**Light**

**Electromagnetic Waves**

**Characteristics of Light**

* Does not require a medium.
* Travels in a straight path.
* **Speed** - 299, 792, 458 m/s
* 499 seconds or approximately 8 minutes.
* Form of energy made of photons.
* Natural source of light is the sun.
* Artificial sources of light are fire and lightbulbs.

**Intensity:**

* Power of light.
* Quantity that measures the amount of light illuminating a surface.
* **Brightness** - Visual perception in which a light source seems to be emitting light or a surface reflecting light.
* **Luminous Intensity** - Amount a light that the object's produce.
* Brightness of light depends on how far you are from the source.

**Color:**

* The color of light depends on frequency or wavelength the reaches the eye.
* **Red** - Longest wavelength, lowest frequency.
* **Violet** - Shortest wavelength, highest frequency.
* **White** - Combinations of all the wavelengths of visible light.
* **Black** - Absence of wavelengths.

**Equation of Waves**

**Variables, Units, and Symbols:**

|  |  |  |  |
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| **Quantity Symbol** | **Quantity Term** | **Unit** | **Unit Symbol** |
| v | Wave Speed | Meters/second (m/s) | m/s |
|  | Wavelength | Meter | m |
| f | Frequency | Hertz | Hz |

**Formulas**

* **Wave Speed:**
* **Wavelength:**
* **Frequency:**

**Example of Problems**

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| **Problem:** | **Solution:** |
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| **Problem:** | **Solution:** |
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| **Problem:** | **Solution:** |
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