What’s in a Wave?

*What’s in a Wave?*  is an activity centered around understanding mechanical waves and taking a deeper dive into sound waves. Students will be given the option to create artifacts that help develop an understanding of waves from materials found around the house if applicable.

**LEARNING OBJECTIVES**

**Students will know:**

* The different types of waves: Transverse, Longitudinal, Mechanical, and Electromagnetic
* Characteristics of wave: velocity, amplitude, frequency, crest, trough, and wavelength
* Parts of a speaker
* How a speaker creates sound
* Sound waves change speed when passing through a medium, and which medium allows for the fastest or slowest travel

**Students will understand:**

* Waves are all around us even though they cannot be seen, smelt, or felt
* Law of Conservation of Energy

**Students will be able to:**

* Build a transverse wave model
* Build a homemade speaker from paper plates and magnets
* Measure the decibels produced from their homemade speaker using their phones
* Solve for velocity, wavelength or frequency given the value of two of the three variables
* Draw the change in wave speed when passing through a medium
* Identify parts of a wave: amplitude, trough, crest, and wavelength
* Differentiate between longitudinal and transverse waves

**UNIT PLAN**

**Pre-Laboratory Engagement (30 minutes)**

1. Watch [video](https://vimeo.com/412362682) on transverse and longitudinal waves.
   1. This video will also cover the characteristics of a wave and how to calculate a wave’s velocity.
   2. You can also have them follow along using the [instructions](https://drive.google.com/open?id=1TfHmOEgUFdEYQCs7_vlooG715xgRwzXUY3kKbjqZh_o) from the video to build your own wave machine
2. Students complete a [handout](https://drive.google.com/open?id=1Zso_FeLwmUHjdNvscQrkFcnRLRUsSIoswO6b5nK6vY0) to enforce learning from video and allow for mathematical practice.
   1. [Handout key](https://drive.google.com/open?id=1rKpSPq4lNhxvH4ppyUDBmbC8oxRehS7iq1O6uOY3gE4)

**Laboratory Activity (30 minutes)**

1. Students watch [video](https://vimeo.com/412367696) presenting their engineering design challenge on homemade paper plate speakers.
2. Students then use their [student handout](https://drive.google.com/open?id=1-RueXCYXwaiioZAsRLjcsCINv2NMceea-DXYMixiSnc) to record their changes on the prototype design.

**Post-Laboratory Extension (30-45 minutes)**

1. Students will complete a [handout](https://drive.google.com/open?id=1CuLtphb8XWyuiYMZnPJTuSHpFfzT0W-6rj2wHExQPrA) that introduces how waves change when traveling through a medium.
   1. They they can check their understanding with a post-lab [video](https://vimeo.com/412377566) solving the student handout or by using the student [handout key](https://drive.google.com/open?id=1NMy31alalON74JDgn5yQ42MDsb8hg2b-2S3S2_XeuJw)

**STANDARDS ALIGNMENT**

**NGSS CONNECTIONS**

**MS-PS4-1:** Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy of a wave

**MS-PS4-2:** Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials

**TEKS CONNECTIONS**

**PHYSICS.7(B):** Investigate and analyze characteristics of waves, including velocity, frequency, amplitude, and wavelength, and calculate the relationship between wave speed, frequency, and wavelength.

**PHYSICS.7(C):** Compare characteristics and behaviors of transverse waves, including electromagnetic waves and the electromagnetic spectrum, and characteristics and behaviors of longitudinal waves, including sound waves

**LSS CONNECTIONS**

**6-MS-PS2-3:** Ask questions about data to determine the factors that affect the strength of electric and magnetic forces

**6-MS-PS4-1:** Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave and how the frequency and wavelength change the expression of the wave.