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| Macintosh HD:Users:McGarry:Desktop:phetlogo.png | **Waves Investigation – 60 min Lesson**  **PreAP Physics** |

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| PRE-PLANNING | PRIOR KNOWLEDGE | |
| * A wave is any disturbance that carries energy through matter or space. | |
| LEARNING GOALS | |
| * Investigate the properties of a transverse wave. * Observe how waves behave when they have a loose, fixed or no end. | |
| Common Core Standards | Texas Essential Knowledge and Skills (TEKS) |
| NGSS Science Content HS-PS4-1  Use mathematical representations to support a claim regarding relationships among the frequency, wavelength and speed of waves traveling in various media.  Crosscutting Concept  Cause and Effect: empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.  Science and Engineering Practices  Using Mathematics and Computational Thinking: use mathematical representations of phenomena to describe explanations | P.7B investigate and analyze characteristics of waves, including velocity, frequency, amplitude, and wavelength, and calculate the relationship between wavespeed, frequency, and wavelength |
| MATERIALS | |
| * PhET *Wave on a String* <https://phet.colorado.edu/en/simulation/wave-on-a-string> * PreAP Wave Investigation Handout – 1 per student * Waves on a String Exit Quiz – 1 per student * Slinky – 1 per pair | |
| LESSON CYCLE | **ENGAGE** *10 minutes* | |
| Pass out 1 slinky per group of 2 students. Ask students to make the slinky have 3 different shapes while having one student hold each end. Have each pair demonstrate the shape they were able to make. Discuss similarities and differences between shapes created. | |
| **Part 1 – Beginning Observations** *10 minutes* | |
| *Teacher will…* | *Students will…* |
| **Pass out** Wave Investigation handout.  **Select** 2-3 students that will share out their observations with the class. If possible, have students show their findings using the teacher computer in front of the room. | **Explore** the simulation and make beginning observations (Part 1 of lab). |
| **Part 2 -3 – Manual and Oscillate** *30 minutes* | |
| *Teacher will…* | *Students will…* |
| **Introduce** lab expectations.  **Circulate** while students are completing the investigation and ask guiding questions.  The following guiding questions could be asked to individual/groups of students as the teacher circulates.  Guiding Questions  1. What are the characteristics of waves?  2. What is amplitude? Tension? Damping?  3. How does the amplitude affect the speed of the wave?  4. Are the waves in the simulation transverse or longitudinal?  5. How do waves behave differently with free and fixed ends? | **Complete** investigations using manual and oscillate functions in simulation. |
| **Exit Ticket** *10 minutes* | |
| *Teacher will…* | *Students will…* |
| **Distribute** Exit Ticket to students.  **Collect** lab investigations | **Complete** their Exit Ticket individually. |