**Energy: Properties of Waves Pre-Test: Answer Key**

1. **B**
2. **A**
3. **D**
4. **A**
5. **D**
6. **C**
7. **B**

**Properties of Waves Guided Notes: Answer Key**

***What is a Wave?***

A wave is a **Disturbance** that travels through a medium from one location to another.

A **Wave** is the motion of the disturbance

***Slinky***

When the slinky is stretched from end to end and is held at **rest** , it assumes a natural position known as the equilibrium **or rest position.**

To introduce a wave here we must first create a **disturbance** . We must move a particle away from its rest position.

***Slinky Activity***

One way to do this is to quickly move the slinky forward. The beginning of the slinky moves away from its equilibrium position and then back. The **disturbance** continues down the slinky.

This disturbance that moves down the slinky is called a **pulse**. If we keep pulsing the slinky back and forth, we could get a repeating disturbance.

This type of wave is called a **longitudinal** wave.

The pulse is transferred through the **medium** of the slinky, but the slinky itself does not actually move.

It **displaces**  (moves) from its rest position and then returns to it.

The metal of the slinky is the **medium** that transfers the energy pulse of the wave. The medium ends up in the same place as it started

It just gets disturbed and then returns to it **rest position**. The same can be seen with a stadium wave.

Let’s start the wave!

***Longitudinal Wave***

The medium particles vibrate **parallel** to the motion of the pulse.

What does parallel mean?

This is the same type of wave that is used to transfer **sound**.

How does this happen?

***Transverse Wave***

Transverse waves travel **perpendicular** to the disturbance.

What does perpendicular mean?

**Perpendicular forms a right angle to the equilibrium.**

How is this different than longitudinal waves?

**Parallel moves in the same direction as equilibrium.**

***Longitudinal vs. Transverse***

**Transverse** waves can be seen when we wiggle the slinky up and down.

They also occur when the source disturbance follows a **periodic** motion. A spring or a pendulum can accomplish this.

The wave formed here is a **SINE** wave.

***Periodic Waves***

Think of some things that happen periodically…Weather patterns, Temperatures, Imperfections in cable. What are some others?

***Parts of a Wave***

The points A and F are called the **CRESTS** of the wave.

This is the point where the wave exhibits the maximum amount of positive or upwards **displacement.** The highest it’s going to get!

The points D and I are called the **Troughs** of the wave.

These are the points where the wave exhibits its **maximum** negative or downward displacement. The lowest it’s going to get!

The distance between the dashed line and point A is called the **amplitude** of the wave.

This is the maximum displacement that the wave moves away from the **equilibrium**.

The distance between two **consecutive** similar points is called the wavelength. The easiest to see is between 2 crests.

Between what other points (pairs) can a wavelength be measured?

***Frequency***

You should know that frequency measure how often something happens over a certain amount of **time**.

We can measure how many times a wave passes a fixed point over a given amount of time, and this will give us the frequency.

If I move a slinky up and down, and count that 10 waves pass a point in 5 seconds. What would the frequency be?

**2** cycles / second **2** Hz

Use the term **Hertz** (Hz) to stand for cycles per second.

***Period***

The period describes the same thing as it did with a pendulum. It is the time it takes for one cycle to complete. It also is the **reciprocal** of the frequency.

What does reciprocal mean?

T = 1 / f f = 1 / T

***Wave Speed***

You can use what we know to determine how **fast** a wave is moving.

What is the formula for velocity? **Velocity = Distance / Time**

What **distance** do we know about a wave? **Wavelength**

What **time** do we know? **Period**

Plug these values in and get:

Velocity = Length of wave / Time for wave to move pass a fixed point

V = λ / T \*the symbol λ represents wavelength

What does T equal in terms of frequency? **T = 1 / f**

You can also write: V = f λ

Velocity = Frequency x Wavelength

This is known as the **wave equation**.

**Career Day! Answer Key**

**Engineering Web Quest**

**1. Engineering**

**https://www.youtube.com/watch?v=98OQpZPOnko**

**A. What is an engineer?**

**An engineer is someone who “turns dreams into reality.” They follow the engineering design process to attain their goals. A person that designs, creates, or improves machines or materials.**

**B. List the steps of the engineering process**

**1. Identify a need 2. Define the problem 3.Conduct Research**

**4. Refine the research 5.Analyze Constants 6.Search for alternative solutions**

**7.Analyze possible solutions 8. Make decisions 9. Repeat**

**2. Product Engineer**

**https://www.youtube.com/watch?v=Llk04somtBU**

**A. List 3 things that a product engineer does.**

**\*\*There can be many possible answers: design new products, build the products from the design, understand how things work, test devices, reduce the time it takes to test devices.**

**B. What are the goals of a product engineer?**

**To have an efficient completed project**

**C. What are potential problems that product engineers could face? List at least 2 and explain your answers.**

**Engineers could face problems getting their ideas across to other people. They could experience design flaws or production setbacks.**

**3. Materials Engineer**

**https://www.youtube.com/watch?v=DtosXFgP7C4**

**A. List 4 things that Materials Engineers work with**

**1.Structure 2. Properties**

**3.Processing 4.Performance**

**B. Name at least 3 things that Materials Engineers have created.**

**Artificial Skin, Command strips, Prosthetics, high performance composites, sports equipment, sports apparel, adhesives (sticky stuff).**

**C. What are potential problems that materials engineers could face? List at least 2 and explain your answers.**

**They are always trying to improve a design, so they are never really finished.**

**D. What kind of education would you need to be a materials engineer?**

**Bachelor of Science degree in Chemical engineering, mechanical engineering, or materials engineering. Most continue on the get a Master of Science degree in materials engineering.**

**4. Process Engineer**

**http://www.aboutbioscience.org/careers/processengineer**

**A. What are the 2 main responsibilities of a Process Engineer?**

**Develop new industrial processes and design new process equipment.**

**B. List at least 3 other people a Process engineer might interact with.**

**Materials engineer, Product engineer, and controls engineer.**

**C. What are potential problems that process engineers could face? List at least 2 and explain your answers.**

**Is the process going to be efficient? Is the process going to work with the materials given?**

**D. What kind of education would you need to be a process engineer? What high school courses could you take?**

**One should learn the basic principals of science and math in high school by taking the highest levels of these courses offered at your school. These classes will prepare you for college where you should get a B.S. in engineering. Most will go on to get a Masters degree.**

**5. Controls Engineer**

**http://education-portal.com/articles/Become\_a\_Controls\_Engineer\_Education\_and\_Career\_Roadmap.html**

**A. What are at least 3 things that a Controls Engineer does?**

**Again, answers can vary.**

**Talks to customers, easily acquires skills, works with computers, makes machines more efficient, and determines how things work…**

**B. What are potential problems that controls engineers could face? List at least 2 and explain your answers.**

**Some skills may be harder to learn than others. Problems can always arise when working with others.**

**C. What kind of education would you need to be a Controls engineer?**

**Strong math and science skills are required, so taking advanced classes in high school is recommended. A Bachelor of Science degree in engineering is recommended as well as a master’s degree.**

**D. What special skills might you need to be a controls engineer?**

**Strong computer skills, attention to detail, teamwork, active learning skills.**

**6. Test Engineer**

**https://www.youtube.com/watch?v=ijX7WAtjOdM**

**A. List at least 4 things that Test engineers do.**

**Test projects for safety and efficiency. Make sure products work as they are designed. Suggest solutions if the products do not work.**

**B. What special skills might you need to be a Test engineer?**

**Oral communication skills and the ability to present in front of large groups. Problem solving skills.**

**C. What kind of education would you need to be a Test engineer?**

**Math and science classes in high school. B.S. degree in engineering and a strong background in working with customers.**

**D. What are potential problems that controls engineers could face? List at least 2 and explain your answers.**

Making sure the product is at a cost the customer can afford. Products not only have to be well made and efficient, but they also have to be affordable.