

Make an Invisible TV with Science!



**IMPOSSIBLE
SCIENCE**

Objective: Students will demonstrate the difference between transverse and longitudinal waves.



Hook:

1. Bang a drum hard in front of the class. Explain to students that the reason they could hear the sound is because of longitudinal sound waves traveling from the drum to their ears. The vibrating air creates a sound wave that travels through the air to the ear, which in turn vibrates. Explain that longitudinal waves travel parallel to the direction of travel. Tell students that today they will use their knowledge of waves to create an invisible television, but first, they must understand the different types of waves.

Procedure:

1. Remind students that waves transfer energy from one place to another, and explain that there are two types of waves: transverse and longitudinal.

Materials:

- Cheap used LCD television screen (a few if you can find them)
- -Screwdriver
- -Razor
- -Gloves
- -Goggles
- -Glasses frames
- -Polarizing filter
- -Tape
- -Marker
- -Slinkies (enough for half of the class)

Vocabulary:

Waves: Waves transfer energy from one place to another.

Longitudinal Wave: forwards and backwards motion parallel to the direction of travel.

Transverse Wave: When the wave moves perpendicular to the wave direction.

Polarizing Filter: Reduces the transverse wave based on the angle the wave passes through it.
Polarization restricts the light waves to a particular plane. Only transverse waves can be polarized.

2. Pair students up and give each pair a slinky. Have one student hold each end of the slinky and tell students to face each other with the slinky a few feet apart until it is stretched out, but not too tight.
3. First, have one student pull their end of the slinky back and forth horizontally once or twice while the other student holds their end still. Students should watch as a longitudinal wave moves back and forth, parallel to the direction of travel.
4. Have students pause to write down the definition of longitudinal waves and draw a diagram of the horizontal slinky motion in their notebooks.
5. Have students stand again, each holding an end of the slinky, but this time, have students move their hands up and down (instead of back and forth) to create a transverse wave that travels perpendicular to the direction of travel.
6. Have students write down the definition of transverse waves in their notebooks and draw a diagram of the slinky motion.
7. Tell students that today they will get to witness how polarizing filters control light waves help us see television. Explain how polarizing filters work (above) and have students copy the definition into their notebooks.
8. Show students Impossible Science video to 3:11, pausing to explain and have students add to notes as needed.
9. Building the television!

- A. Walk students through the directions for building the invisible television below- you may do it as a class if you have one television, or in supervised small groups if you have a few:
- B. Unscrew the back of the (unplugged) television screen and lift off the back of the screen.
- C. Remove screws from the bezel.
- D. Remove the TV's polarizing filter by starting in the corner and cutting out one side at a time along the edge. Lift the filter and use adhesive remover to remove remaining glue.
- E. Put the TV back together using the screwdriver.
- F. Trace glasses frames onto the polarizing filter using the marker, and cut out to fit lenses into the frame.
- G. Tape lenses onto the frame.

Assessment:

Write the following questions on three different sections of the white board and have students add their responses:

1. How did the polarization filter allow the image to come through?
2. What was happening to the light waves?
3. Why did the television appear white?

Have student pairs schedule times to invite another teacher or student to view their invisible television, and assess their understanding as they explain to the outsider how the television works using the terms polarizing filter, transverse waves, longitudinal waves.

Safety Note:

Adult Supervision Recommended

Watch the companion video here:



Lesson Plan by Whitney Gallagher based on the "Impossible Science" series.

Find more at impossiblescience.com

