

Waves: demonstrating P and S waves in a box

Key
stage
4/5

The scenario

With this equipment you can show how P and S waves can be recorded by an accelerometer on a tablet device. This will allow students to get a concept of how the different waves will combine in a seismograph trace.

The activity (making the box)

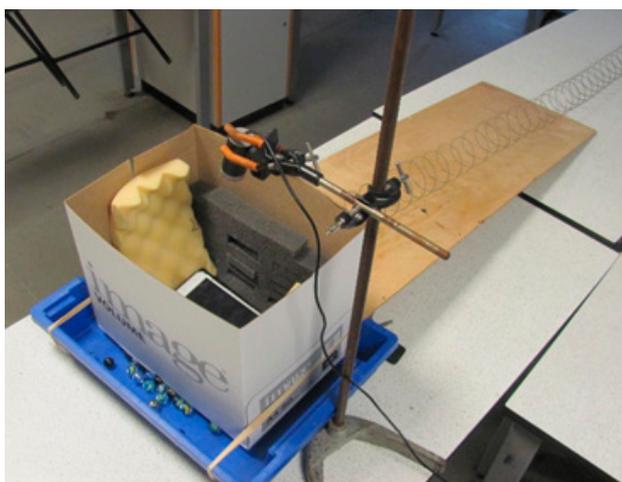
1. Line the box with enough foam to hold the tablet computer firmly but gently.
2. Place about 15 marbles in a tray.
3. Wrap the elastic band around the tray near the ends until they hold the box between them on top of the marbles. Try shaking the box to check that it will move reasonably freely in both horizontal directions.
4. Attach a slinky to the side of the box. This can be done by puncturing a hole carefully into the side of the box at a suitable height so that the slinky is not caught by the tray. The slinky can then be screwed through this hole and secured with sticking tape. Alternatively a bespoke attachment could be made.
5. A piece of plywood board can be placed on the edge of the tray to allow a smooth transition of the slinky from the table/floor surface to the box.
6. A webcam is now pointed into the box held in place by a boss, clamp and stand. The image is projected on to a screen.
7. The tablet runs a suitable wave recording app. There are number of these available which work fairly simply. It is helpful if the app chosen shows the traces separately rather than on top of each other and has the facility to turn the z-axis (up-down) off.

Learning objectives

- properties of longitudinal and transverse waves

Equipment needed

- photocopier paper box
- equipment tray
- 2 large elastic bands (c.15 cm long)
- slinky spring
- about 15–20 marbles
- tablet computer with seismometer app
- foam
- long board
- scissors
- sticking tape
- webcam



The copier box, containing the tablet, sits on top of a tray of marbles. The box is held steady by the elastic bands, but it must be able to move freely in both horizontal directions.

The activity (demonstration)

1. Start the app on the tablet.
2. Longitudinal and transverse waves are made and recorded by shaking the far end of the slinky to and fro and from side to side respectively. These are viewed by the class projected onto a screen. It can be helpful to have one person start the app and another shake the slinky as this allows shorter files to be recorded.
3. The demonstration will not completely isolate the P and S waves as the slinky always has a small amount of the other wave when shaken in a longitudinal or transverse direction.
4. Students can experiment with stretching the slinky out more and repeating. What, if any effect does a more stretched slinky have on the results?

