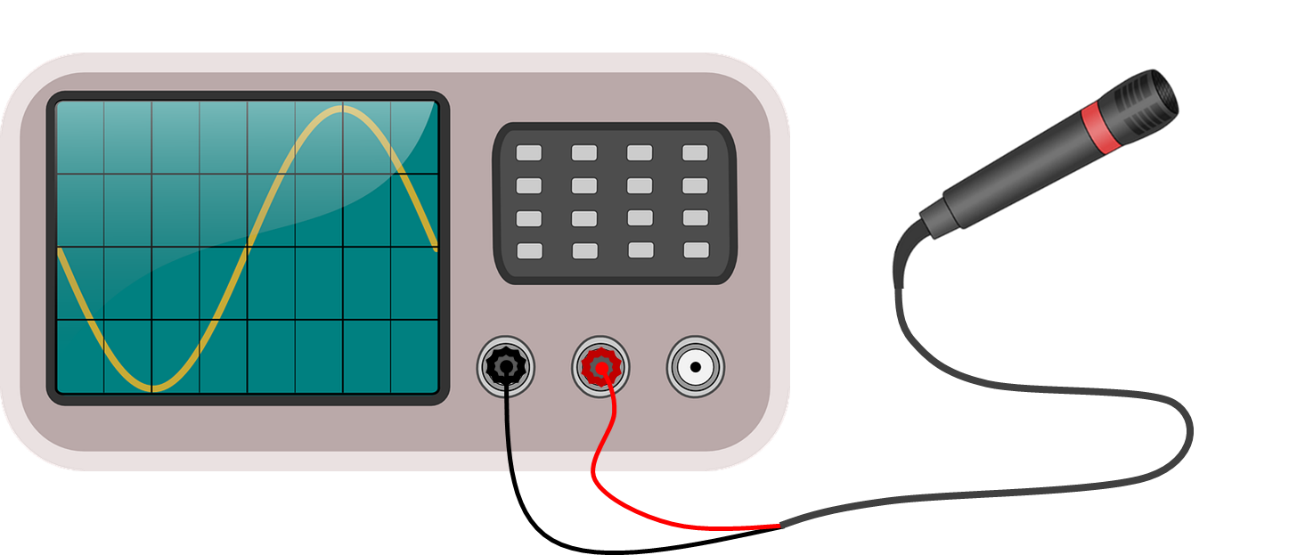
**Oscilloscope graph**

An oscilloscope and a microphone can be used to make a graph of a sound wave.

The oscilloscope makes a displacement-time graph.



Use *all* the statements to explain how a graph of a sound wave is made on an oscilloscope.

*Start with:*

Inside a microphone is a thin diaphragm that can move.

A negative p.d. is made when it moves the other way.

When it is on, the dot moves across the screen at a steady speed.

A soundwave can move it backwards and forwards.

This makes the dot on the oscilloscope move up or down.

A positive p.d. is made when it moves one way.

When it is off, a sound wave can only move the dot up or down.

Changing the time-base changes the scale on the time axis.

The time-base changes how quickly the dot moves across the screen.

Explaining an oscilloscope graph – cards

A negative p.d. is made when it moves the other way.

When it is on, the dot moves across the screen at a steady speed.

A soundwave can move it backwards and forwards.

This makes the dot on the oscilloscope move up or down.

A positive p.d. is made when it moves one way.

When it is off, a sound wave can only move the dot up or down.

Changing the time-base changes the scale on the time axis.

The time-base changes how quickly the dot moves across the screen.

1. Inside a microphone is a thin diaphragm that can move.

Explaining an oscilloscope graph – cards

A negative p.d. is made when it moves the other way.

When it is on, the dot moves across the screen at a steady speed.

A soundwave can move it backwards and forwards.

This makes the dot on the oscilloscope move up or down.

A positive p.d. is made when it moves one way.

When it is off, a sound wave can only move the dot up or down.

Changing the time-base changes the scale on the time axis.

The time-base changes how quickly the dot moves across the screen.

1. Inside a microphone is a thin diaphragm that can move.

*Physics > Big idea PSL: Sound, light and waves > Topic PSL5: Measuring waves > Key concept PSL5.1: Visualising waves*

|  |
| --- |
| **Response activity** |
| **Oscilloscope graph** |

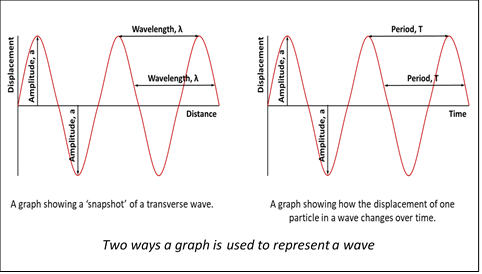
**Overview**

|  |  |
| --- | --- |
| Learning focus: | The motion of particles in a wave can be represented by a displacement-distance or a displacement-time graph, from which the wave’s amplitude and wavelength or time period can be found. |
| Observable learning outcome: | Explain how a displacement-time graph relates to the wave it describes. |
| Activity type: | Explanation story |
| Key words: | Displacement, time-base |

This activity can help develop students’ understanding by addressing the sticking-points revealed by the following diagnostic questions:

* Diagnostic question: New wave graph
* Diagnostic question: Sound graph

**What does the research say?**

****There are two common ways to represent a wave in the form of a graph (Caleon and Subramaniam, 2010). The first shows either a snapshot of a transverse wave, such as a wave on a rope, or the forwards and backwards displacement of particles in a longitudinal wave. The second graph shows how the displacement of one particle of a wave changes over time. On this graph the peak-to-peak separation on the graph is the time period of the wave. Caleon and Subramaniam (2010) found that the majority of students aged 15 and 16 (n=598) do not clearly distinguish between these two representations.

Some students may think of a wave’s graph as a picture of the wave drawn to scale, which in most cases it is not. This way of thinking about graphs of waves can get in the way of understanding graphs of longitudinal waves and of interpreting displacement-time graphs.

**Ways to use this activity**

This task is intended for discussion in pairs or small groups. It is best done as a pencil and paper exercise.

Students should read the statements and follow the instructions on the worksheet. Listening in to the conversations of each group will often give you insights into how your students are thinking. Each member of a group should be able to report back to the class.

Feedback from each group can be used, with careful teacher questioning, to bring out a clear description or explanation of the science.

*Differentiation*

The quality of the discussions can be improved with a careful selection of groups; or by allocating specific roles to students in each group. For example, you may choose to select a student with strong prior knowledge as the scribe, and forbid them from contributing any of their own answers. They may question the others and only write down what they have been told. This strategy encourages contributions from more members of each group.

NB in any class, small group discussions typically improve over time and a persistence with this strategy is often very successful in the medium to long term.

**Expected answers**

1. Inside a microphone is a thin diaphragm that can move.
2. A soundwave can move it backwards and forwards.
3. A positive p.d. is made when it moves one way.
4. A negative p.d. is made when it moves the other way.
5. This makes the dot on the oscilloscope move up or down.
6. The time-base changes how quickly the dot moves across the screen.
7. When it is off, a sound wave can only move the dot up or down.
8. When it is on, the dot moves across the screen at a steady speed.
9. Changing the time-base changes the scale on the time axis.

**Acknowledgments**

Developed by Peter Fairhurst (UYSEG).

Images: Peter Fairhurst (UYSEG) using images of an oscilloscope and a microphone by Clker-Free-Vector-Images from Pixabay.

**References**

Caleon, I. S. and Subramaniam, R. (2010) 'So Students Know What They Know and What They Don't Know? Using a Four-Tier Diagnostic Test to Assess the Nature of Students' Alternative Conceptions', *Research in Science Education,* 40 (3), pp. 313-337.