**ACTIVITY: Similarities and differences: tsunamis and surf waves**

**Activity idea**

In this activity, students use an interactive or paper-based Venn diagram to illustrate the key similarities and differences between tsunami waves and surf waves.

By the end of this activity, students should be able to:

* describe the key similarities and differences between tsunami waves and surf waves
* understand how to use a Venn diagram to graphically organise information

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**Introduction/background**

We often imagine that tsunamis look like huge surf waves. Surf and tsunami waves have some characteristics in common, but there are also many differences.

The following table provides a summary of similarities and differences. Refer to article [Comparing tsunamis and surf](https://www.sciencelearn.org.nz/resources/125-comparing-tsunamis-and-surf) for more detailed explanations between the two waves. Several other articles ([Fundamentals of waves](https://www.sciencelearn.org.nz/resources/119-fundamentals-of-waves), [Behaviour of waves](https://www.sciencelearn.org.nz/resources/121-behaviour-of-waves) and [Waves as energy transfer](https://www.sciencelearn.org.nz/resources/120-waves-as-energy-transfer)) also provide important background information on waves.

|  |  |  |
| --- | --- | --- |
| **Tsunami waves only** | **Both tsunamis and surf waves** | **Surf waves only** |
| * Can travel at hundreds of km/h * Wavelength of hundreds of km * Caused by an in-water disturbance * Period of 10–60 minutes * Usually non-breaking waves * Occupy the whole ocean depth * May form a turbulent bore | * Can reflect and refract * Can undergo diffraction * Can interfere with other waves * Can resonate (‘slosh’) * A form of energy transfer * Have a frequency and wavelength * Slow down in shallow water * Become higher in shallow water | * Travel at less than 50km/h * Wavelength of tens of metres * Caused by wind * Period of a few seconds * Breaking waves * Occupy the water surface only * Suitable for surfing |

***Venn diagrams***

Venn diagrams have been used for over a hundred years as a visual way to show the similarities and differences between two or more things (for example, concepts or products).

In a Venn diagram, two or more circles overlap – features common to only one thing appear in their respective circles, and features common to both appear in the overlapping area of the circles.

For example, tsunami waves (but not surf waves) are caused by a massive underwater disturbance, so this feature belongs in the tsunami circle, but both tsunami and surf waves are modes of energy transfer, so this feature belongs in the overlapping area.

**What you need**

* Access to the [interactive Venn diagram](https://www.sciencelearn.org.nz/drag_and_drops/1-similarities-and-differences-tsunamis-and-surf-waves) or the printed [list of features](#features) and [Venn diagram worksheet](#worksheet)
* Access to the article [Comparing tsunamis and surf](https://www.sciencelearn.org.nz/resources/125-comparing-tsunamis-and-surf) (optional).

**What to do**

1. Have the students read the article [Comparing tsunamis and surf](https://www.sciencelearn.org.nz/resources/125-comparing-tsunamis-and-surf).

1. Draw a sample Venn diagram on the board and discuss with the students what they can be used to show. It might be helpful to model how they work with another example, such as a lake and the sea.
2. Allow the students sufficient time to complete the [interactive Venn diagram](https://www.sciencelearn.org.nz/drag_and_drops/1-similarities-and-differences-tsunamis-and-surf-waves), either individually, in small groups or as a whole class. There is also the option to use a paper-based version. Provide the [list of features](#features) and ask students to complete the [Venn diagram worksheet](#worksheet).
3. Give individuals or groups the opportunity to feed back. Any disagreements can be resolved by referring to the article [Comparing tsunamis and surf](https://www.sciencelearn.org.nz/resources/125-comparing-tsunamis-and-surf) or additional articles: [Fundamentals of waves](https://www.sciencelearn.org.nz/resources/119-fundamentals-of-waves), [Behaviour of waves](https://www.sciencelearn.org.nz/resources/121-behaviour-of-waves) and [Waves as energy transfer](https://www.sciencelearn.org.nz/resources/120-waves-as-energy-transfer).

**Discussion questions**

* Why can’t people surf a tsunami? (Usually not a breaking wave, tsunami waves travel too fast, the waves do not end at the beach – they travel inland – so could be full of debris.)
* Why might surfers like the idea of surfing a tsunami? What kind of wave might they be imagining?

**Extension ideas**

Use a Venn diagram with three overlapping circles to explore similarities and differences between water, sound and light waves. Refer to the articles [Fundamentals of waves](https://www.sciencelearn.org.nz/resources/119-fundamentals-of-waves), [Behaviour of waves](https://www.sciencelearn.org.nz/resources/121-behaviour-of-waves) and [Waves as energy transfer](https://www.sciencelearn.org.nz/resources/120-waves-as-energy-transfer) for background information. Students could carry out their own research online to identify further similarities and differences.

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| **Only water waves** | * Wavelength up to hundreds of kilometres * Transfer energy through movement of water particles * Speed is highly variable (up to hundreds of kilometres an hour) |
| **Only sound waves** | * Transfer energy through vibration of air particles or particles of a solid * Travel at 340 metres per second in air at 15°C |
| **Only light waves** | * Transfer energy through oscillating electric and magnetic fields * Travel at 300 million metres per second |
| **Water and sound waves** | * Transfer energy through vibration of particles |
| **Water and light waves** |  |
| **Sound and light waves** |  |
| **Water and sound and light waves** | * Undergo reflection, refraction * Undergo diffraction and interference * Resonate * A form of energy transfer * Can be described by the equation v = f x λ (speed = frequency x wavelength |

**List of features**

|  |  |
| --- | --- |
| A form of energy transfer | May form a turbulent bore |
| Become higher in shallow water | Occupy the water surface only |
| Breaking waves | Occupy the whole ocean depth |
| Can interfere with other waves | Period of 10–60 minutes |
| Can reflect and refract | Period of a few seconds |
| Can resonate (‘slosh’) | Slow down in shallow water |
| Can travel at hundreds of km/h | Suitable for surfing |
| Can undergo diffraction | Travel at less than 50km/h |
| Caused by an in-water disturbance | Usually non-breaking waves |
| Caused by wind | Wavelength of hundreds of km |
| Have a frequency and wavelength | Wavelength of tens of metres |

**Venn diagram worksheet**

