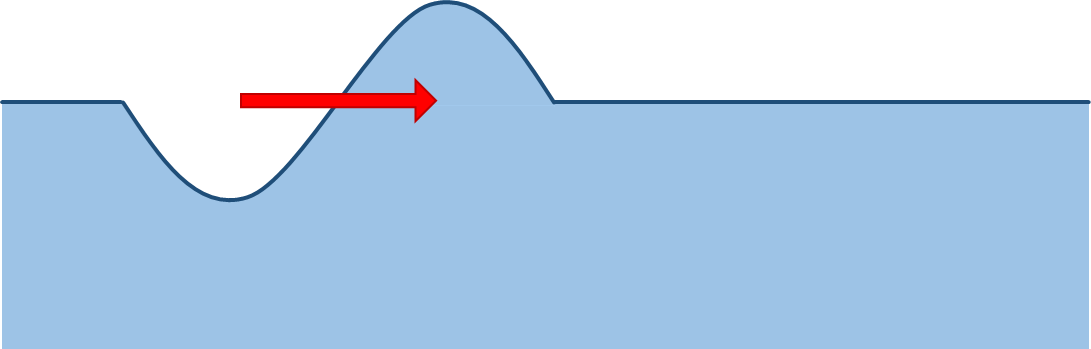
**A moving wave**

Water waves move through water.

But what is it that is really moving?



What moves **forward** with a water wave?

*Put a tick (✓) in the box next to the best answer.*

|  |  |  |
| --- | --- | --- |
| **A** | Just water moves forward. |  |
|  |  |  |
| **B** | Just the ‘shape’ of the wave moves forward. |  |
|  |  |  |
| **C** | The ‘shape’ of the wave *and* water both move forward. |  |
|  |  |  |
| **D** | A force pushing the water moves forward. |  |

*Physics > Big idea PSL: Sound, light and waves > Topic PSL4: Waves > Key concept PSL4.1: Waves on water and ropes*

|  |
| --- |
| **Diagnostic question** |
| **A moving wave** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | A transverse wave travelling across the surface of water (or along a rope) transfers energy, as particles of water (or rope) are successively made to vibrate at right angles to the direction in which the wave travels. |
| Observable learning outcome: | Recognise that as a transverse wave travels forward, the medium through which it travels does not. |
| Question type: | Simple multiple choice |
| Key words: | Wave |

|  |  |
| --- | --- |
| **P** | **PRIOR UNDERSTANDING**  This diagnostic question probes understanding of ideas that are usually taught earlier in the progression of teaching for students aged 11-14, to aid progression from earlier stages of learning. |

**What does the research say?**

When waves move through a medium students often describe the movement of some entity (perhaps mass, matter or force) through the medium. The scientific explanation involves no such movement. A wave moves forwards when a perturbation passes through a medium, and after it has passed the material of the medium returns to its original position. This is what distinguishes the motion of a wave from the motion of an object. (Fazio et al., 2008)

**Ways to use this question**

Students should complete the question individually. This could be a pencil and paper exercise, or you could use an electronic ‘voting system’ or mini white boards and the PowerPoint presentation.

The answers to the question will show you whether students understood the concept sufficiently well to apply it correctly.

If there is a range of answers, you may choose to respond through structured class discussion. Ask one student to explain why they gave the answer they did; ask another student to explain why they agree with them; ask another to explain why they disagree, and so on. This sort of discussion gives students the opportunity to explore their thinking and for you to really understand their learning needs.

*Differentiation*

You may choose to read the questions to the class, so that everyone can focus on the science. In some situations it may be more appropriate for a teaching assistant to read for one or two students.

**Expected answers**

B: Just the ‘shape’ of the wave moves forward.

**How to respond - what next?**

As the wave moves forward through the water, the water particles move up and down. The shape of the wave continues forward, although over time it may diminish in size due to damping effects.

A significant number of students are likely to think that something is moving forward with the wave and the most obvious thing is the water - answer C.

Answer A suggests thinking that the wave is moving forward in the same way as an object such as a ball; or that water is moving forward and the wave is changing shape.

Answer D suggests students have the misunderstanding that forces are needed to keep something moving at a steady speed. Alternatively it may be that students realise that the water is not moving forward, but ‘something else’ is.

N.B. It is perhaps not so silly to think that ‘something else’ could be a force, if students have noticed that waves hit a shoreline with a force. This a real force, but not a force caused by a transverse wave moving at a steady speed. What usually happens as waves move towards a shoreline is that the water gets shallower. The change of depth changes the speed of the wave, and causes it to build up and crash onto the shore. Waves moving at a steady speed (when depth is constant) don’t do this. The water in these waves moves only up and down (with a slight circular motion).

If students have misunderstandings recognising that as a transverse wave travels forward, the medium through which it travels does not, it can help to demonstrate to students what is actually happening. One way is to use a line of students to demonstrate a *Mexican wave*. This requires the students to start off seated. The student at one end stands up and sits down, whilst the student next to her/him does the same, but they stand only after they see the first student starting to rise up. This continues along the row so the wave moves forward but the students remain in place.

A second demonstration uses a rope or a ‘slinky spring’. The rope (or spring) is placed (or stretched) along a desk with a small piece of string tied half-way along its length. A sharp side-to-side movement of the hand, which is holding one end, sends a transverse wave along its length. Observing the piece of string shows that as the wave passes along the rope (or spring), each part moves only in a side-to-side direction.

The following BEST ‘response activity’ could be used in follow-up to this diagnostic question:

* Response activity: Making waves

**Acknowledgments**

Developed by Peter Fairhurst (UYSEG).

Images: Peter Fairhurst (UYSEG).

**References**

Fazio, C., et al. (2008). Modelling Mechanical Wave Propogation: Guidelines and experimentation of a teaching-learning sequence. *International Journal of Science Education,* 30:11**,** 1491-1530.