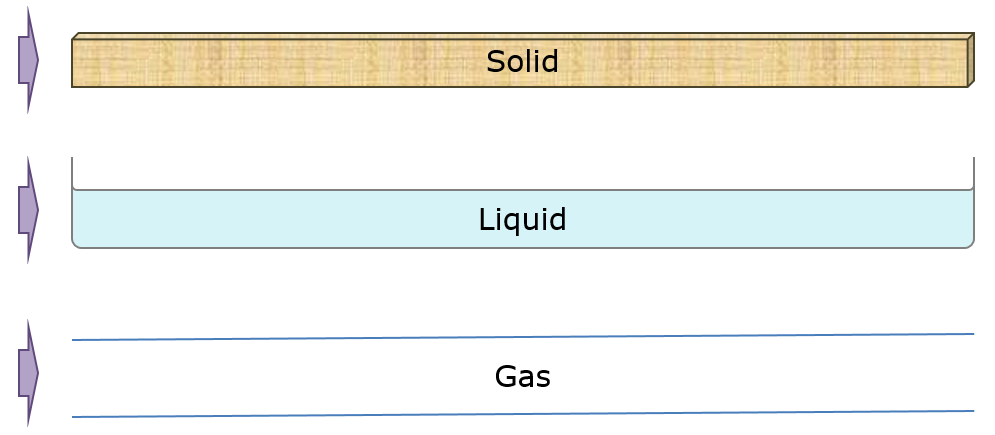
**Sound moves**

When something vibrates it can make a sound.

Sound can travel through solids, liquids and gases.



1. Does sound travel best in a solid, a liquid or a gas?

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

|  |  |  |
| --- | --- | --- |
| **A** | Solid |  |
|  |  |  |
| **B** | Liquid |  |
|  |  |  |
| **C** | Gas |  |

1. Why do you think sound travels best in this?

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

|  |  |  |
| --- | --- | --- |
| **A** | Space for sound to move between particles |  |
|  |  |  |
| **B** | Lots of particles to push the sound along |  |
|  |  |  |
| **C** | Many particles to vibrate and bump into each other |  |
|  |  |  |
| **D** | Particles are joined so it is easy to pass on vibrations |  |

*Physics > Big idea PSL: Sound, light and waves > Topic PSL1: Sound and light > Key concept PSL1.1: Production and transmission of sound*

|  |
| --- |
| **Diagnostic question** |
| **Sound moves** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | Sound needs a medium to travel through. It radiates out from a source in straight lines in all directions and when it strikes an object or new material it is transmitted, reflected, scattered or absorbed – or a combination of these. |
| Observable learning outcome: | Identify which materials sound travels best in. |
| Question type: | Two-tier multiple choice |
| Key words: | Solid, liquid, gas, vibrations, particles |

**What does the research say?**

It is common for students to think that sound only travels through the air and not through solids or liquids.

The transmission of sound is difficult to understand. It is common for students to think of sound a material substance that moves from one place to another (Barman, Barman and Miller, 1996). Even at degree level Linder (1992) found that some students thought of sound as a ‘lump’ of material travelling through a passive medium, similar to a surfer on a water wave.

In his study of twenty-eight 11-14 year olds Whittaker (2012) found that fewer than 30% used the idea of vibrations to correctly describe how sound travels through air. Half the students believed a gap around the door was necessary for sound to enter from the outside, which indicates a view of sound as a material substance. Only 20% were able to explain how sound vibrations can pass through the solid wall.

This question builds on students’ understanding of how sound travels and considers why sound travels best in a solid. It can be a useful follow-up to a practical circus in which students observe sound travelling through a variety of solids, liquids and gases.

**Ways to use this question**

Students should complete the questions 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 follow on question will give you insights into how they are thinking and highlight specific misconceptions that some may hold.

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**

1. A (b) D

**How to respond - what next?**

The correct answer to **part a** (a solid) often surprises students. The simple exercise of gently scratching a table top and then placing an ear against the table shows that sound travels better in a solid than in the air.

For **part b**, answer C is correct, but could also apply to a liquid.

Answer A shows students thinking of sound as a material substance that moves through the air.

Answer B indicates the ‘surfer model’ with a lump of sound being pushed through the air by a wave of air particles. Many students have heard about sound waves and this model is often used fit the idea of vibrating air particles into a misunderstanding that sound is a material substance.

If students have misunderstandings about how sound moves through a solid, a liquid or a gas, then it can be helpful to demonstrate what is happening with a student model. A line of students spaced well out represents a gas. If the student at one end is made to vibrate (for example by an imaginary loudspeaker), the vibration is slow to move along the line because of the gaps between ‘particles’. In a liquid the students are close together and in a solid they are linking arms.

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

* Response activity: String ears

**Acknowledgments**

Developed by Peter Fairhurst (UYSEG).

Images: UYSEG

**References**

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Linder, C. J. (1992). Understanding sound:so what is the problem? *Physics Education,* 27**,** 258-264.

Whittaker, A. (2012). Pupils think sound has substance - well, sort of ... *School Science Review,* 94(346)**,** 3.