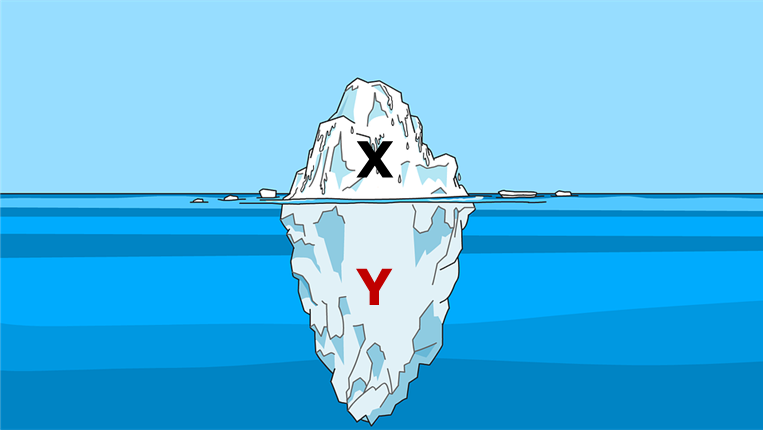
**Iceberg**

Most of an iceberg is below the surface.

Only one tenth of an iceberg can be seen above the surface.



What parts of this iceberg are floating?

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

|  |  |  |
| --- | --- | --- |
| **A** | Only part **X** is floating. |  |
|  |  |  |
| **B** | Only part **Y** is floating. |  |
|  |  |  |
| **C** | Both part **X** and part **Y** are floating. |  |
|  |  |  |
| **D** | No part of the iceberg is floating. |  |

*Physics > Big idea: PMA Matter > Topic PMA2: Floating and sinking > Key concept PMA2.1: Floating, sinking and density*

|  |
| --- |
| **Diagnostic question** |
| **Iceberg** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | An object that is surrounded by a fluid (liquid and/or gas) floats if its overall density is less than the density of the fluid. |
| Observable learning outcome: | Identify objects that are floating. |
| Question type: | Simple multiple choice |
| Key words: | Floating, sinking |

|  |  |
| --- | --- |
| **P** | **PRIOR UNDERSTANDING**  This diagnostic question probes understanding of ideas that are usually taught at age 5-11, to aid transition from earlier stages of learning. |

**What does the research say?**

It is not always obvious to students whether or not an object is floating in a liquid. A survey of 7-14 year olds by Biddulph and Osborne (1984) that is reported by Driver et al. (1994) and Allen (2014), found that most students were only confident that a floating object was floating when a large proportion of the object was visible above the surface of a liquid. When only a small proportion of a floating object was visible above the surface, some students described it as both floating *and* sinking. Others suggested the object was starting to sink and that it would slowly go down. Many students did not recognise that objects could float at all if they were completely submerged. Objects such as fish or submarines *can* float underwater.

**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**

C: both part X and part Y are floating.

**How to respond - what next?**

In everyday language it is common to say that part of the iceberg has sunk, because it has gone underwater.

Here students need to distinguish between object that is floating because it is suspended in a fluid (liquid or gas); and one that is sinking because it is falling through a fluid. As the iceberg is one solid object, it cannot be both suspended and falling at the same time.

In other situations, an object that is floating might be rising up through a fluid.

If students have misunderstandings about which parts of the iceberg are floating, it is likely that they are using the language of floating and sinking in a non-scientific way. It is likely that they need to hear a clear explanation of what we mean by floating and sinking, followed by the opportunity to practise using the terms in order to consolidate their understanding.

A Cartesian diver can be used to demonstrate floating or sinking. Careful questioning can illicit scientific understanding of what we mean by floating and sinking.

*A Cartesian diver is a ‘gismo’ that floats or sinks inside a water filled plastic bottle, depending on whether the bottle is squeezed or not. An example of how to make one can be found on the IoPSpark website at:* [*https://spark.iop.org/cartesian-ketchup-sachet-diver*](https://spark.iop.org/cartesian-ketchup-sachet-diver)*.*

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

* Response activity: Submarines

**Acknowledgments**

Developed by Peter Fairhurst (UYSEG), from an idea in Allen (2014).

Images: Iceberg: <https://pixabay.com/illustrations/iceberg-above-water-white-cold-3273216/>; iceberg photograph on PowerPoint: <https://pixabay.com/photos/iceberg-water-sea-mirroring-nature-471549/>

**References**

Allen, M. (2014). *Misconceptions in Primary Science, 2nd* ednBerkshire, UK: Open University Press.

Biddulph, F. and Osborne, R. (1984). Pupils' ideas about floating and sinking. *Australian Science Education Research Association Conference.* Melbourne.

Driver, R., et al. (1994). *Making Sense of Secondary Science: Research into Children's Ideas,* London, UK: Routledge.