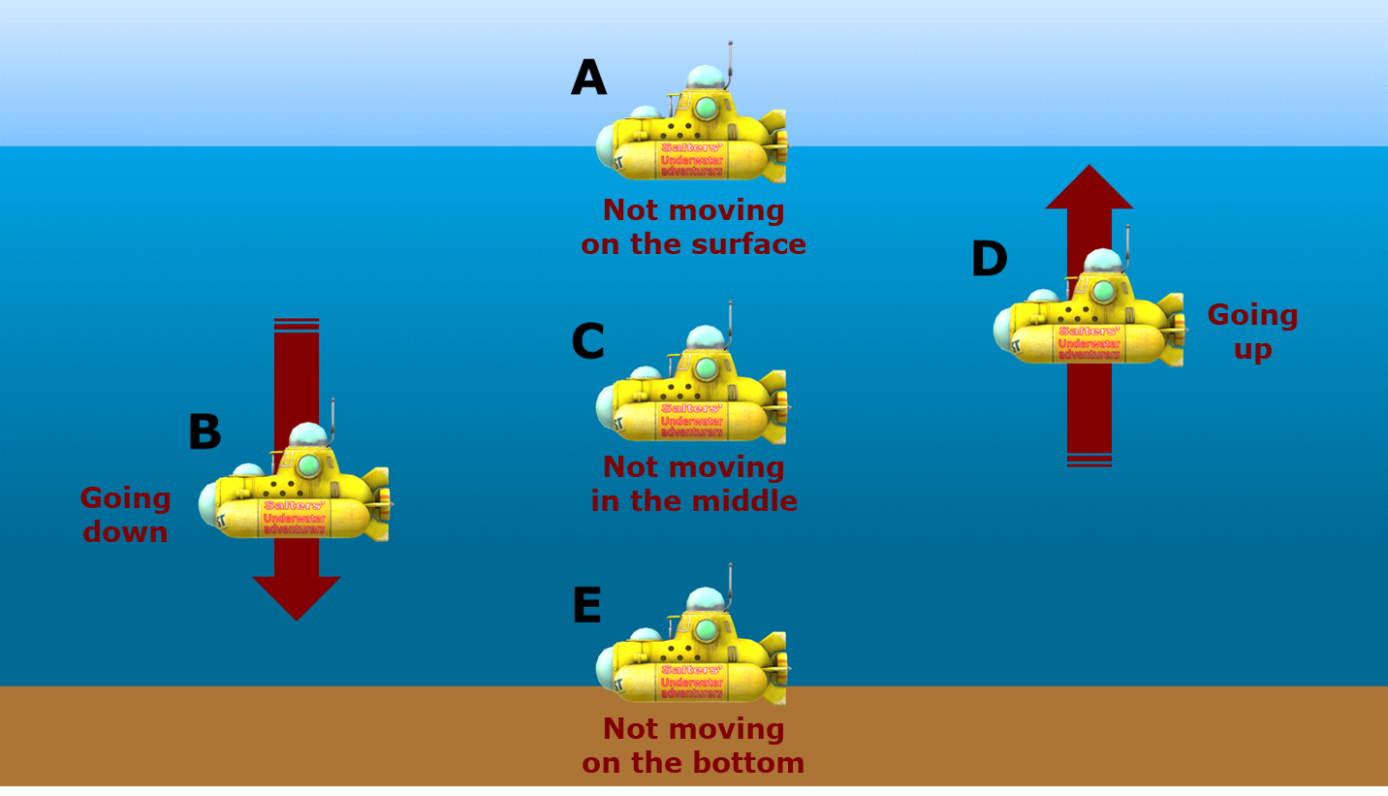
**Submarines**

Submarines can sail like ships.

They can also go underwater.

Which of these submarines are floating?



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

|  |
| --- |
| **Response activity** |
| **Submarines** |

**Overview**

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| --- | --- |
| 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. |
| Activity type: | Application and practice - problem |
| Key words: | Floating, sinking |

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

* Diagnostic question: Iceberg

|  |  |
| --- | --- |
| **P** | **PRIOR UNDERSTANDING**  This activity explores 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 activity**

This activity gives students the opportunity to practise applying their understanding and to clarify their thinking through discussion. To support this, students should answer the question in pairs or small groups.

Listening to individual groups as they work often highlights any difficulties they might have. These can often be overcome, through a whole class clarification or redirection part way through the activity.

Asking students to share the reason for each answer is a useful check. After a group has fed back, it might be helpful to ask if any other group disagrees with the first answer and/or explanation; and if they do then to ask them to explain why. This approach can yield useful discussion that supports the development of a scientific understanding by rising difficulties that students may have, and by giving time to resolving those difficulties through discussion.

*Differentiation*

If some students are working with a teaching assistant, then a list of prompt questions for the TA could help to make this activity more purposeful.

**Expected answers**

Submarines A, C and D are floating.

B is sinking and E is resting on the sea-bed, it is neither floating nor sinking.

**Acknowledgments**

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

Images: Peter Fairhurst (UYSEG).

**References**

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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.