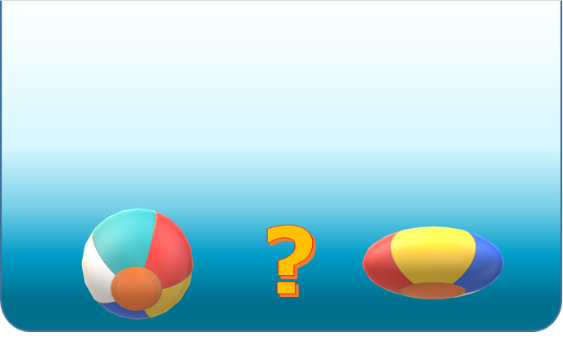
**Underwater beach ball**

A beach ball is full of air.

It is pushed under water.



What happens to the beach ball when it is pushed deeper down?



*For each statement, tick (✓)* ***one*** *column to show what you think.*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | I am **sure** this is right | I think this is right | I think this is wrong | I am **sure** this is wrong |
| **A** | The pressure on the beach ball gets bigger. |  |  |  |  |
| **B** | The ball is squeezed harder in all directions. |  |  |  |  |
| **C** | The ball is squashed flatter. |  |  |  |  |

*Physics > Big idea PMA: Matter > Topic PMA2: Floating and sinking > Key concept PMA2.2: Pressure in fluids*

|  |
| --- |
| **Diagnostic question** |
| **Underwater beach ball** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | Pressure increases with depth in a fluid, so the force exerted by a fluid is larger on the lower surface of an immersed object than on the upper surface. This results in an upward force on the object. |
| Observable learning outcome: | Explain why pressure in a fluid increases with depth. |
| Question type: | Confidence grid |
| Key words: | Pressure, depth |

**What does the research say?**

Engel Clough and Driver (1985) found that 67% of 12-year-olds, 80% of 14-year-olds and 87% of 16-year-olds (n=84) realised that pressure increases with depth in a liquid. However, only 13% of 12-year-olds, increasing to 34% of 16-year-olds recognised that pressure in the liquid acts in all directions. It is common for students to have the misunderstandings: that pressure *is the weight of the liquid;* and that pressure in a liquid pushes only downwards.

The misunderstanding that pressure at a depth in a liquid is equal to the weight of liquid above that point ignores the atmospheric pressure of the air on the surface. For example, the pressure at a one metre depth in water, is about eleven times the water’s weight (Besson, 2004).

**Ways to use this question**

Students should complete the confidence grid 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.

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**

Statements A and B are correct.

Statement C is wrong.

**How to respond - what next?**

Pressure increases with depth because of the extra height of water that needs to be supported; and because water can flow, the pressure pushes equally in all directions. This means that the ball is squeezed harder in all directions.

To squash the ball flatter, pressure would need to increase by a greater amount vertically than in other directions.

If students have misunderstandings about how pressure increases with depth, it can help to elicit students’ experiences of diving deep in a swimming pool. The increased pressure on their ear drums is felt to be the same, no matter which way their head is turned.

A simple demonstration that illustrates how pressing down on a fluid causes it to push in all directions, is to stamp in a puddle!

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

* Response activity: Diving deep

**Acknowledgments**

Developed by Peter Fairhurst (UYSEG).

Images: Peter Fairhurst (UYSEG).

**References**

Besson, U. (2004). Students' conceptions of fluids. *International Journal of Science Education,* 26:14**,** 1683-1714.

Engel Clough, E. and Driver, R. (1985). What do children understand about pressure in fluids? *Research in Science and Technology Education,* 3(2)**,** 133-134.