**Damaged marble**

A group of clouds in the sky

Description automatically generated

Acid-based cleaning products should never be used on a marble surface.

Some students investigate why.

The students place a piece of marble is placed into a test tube containing a hydrochloric acid.

Bubbles are formed. The marble gets smaller.

Explain what happens in the test tube.

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

|  |  |  |
| --- | --- | --- |
| **A** | The marble dissolves in the acid. |  |
|  |  |  |
| **B** | The acid eats away the marble. |  |
|  |  |  |
| **C** | A chemical reaction forms a new soluble substance. |  |
|  |  |  |
| **D** | The marble changes into the gas state. |  |
|  |  |  |

*Chemistry > Big idea CCR: Chemical reactions > Topic CCR4: Acids and alkalis > Key concept CCR4.1: Neutralisation*

|  |
| --- |
| **Diagnostic question** |
| **Damaged marble** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | A salt is formed from a neutralisation reaction between an acid and a base. |
| Observable learning outcome: | Explain what happens when an acid appears to ‘eat away’ a material. |
| Question type: | simple multiple choice |
| Key words: | acid |

|  |  |
| --- | --- |
| **P** | **PRIOR UNDERSTANDING**  This diagnostic question probes understanding of ideas from a previous key concept (CCR1.1) to aid transition from earlier stages of learning. |

**What does the research say?**

Driver (1994) summarises research (Hand and Treagust, 1989) about student conceptions of acids. Two major conceptions were that ‘acids eat material away’ and ‘acids burn you’. It was found that a widely held idea was that an acid could be tested for by seeing whether it ate something away. Researchers found that, even after use of a ‘conflict’ teaching strategy one third of students still did not perceive the reaction of acids with either metals of calcium carbonate as being due to the properties of an acid. Instead they saw them as further examples of ‘acids eating something away’.

This may be explained by the findings of research by Andersson (1990) which categorised five different types of answer that students gave when explaining observations of chemical reactions. Only one of these categories, chemical interaction in which substances combine to form a new substance of substances is scientifically correct. The perception of acids as ‘eating away’ a material is consistent with the category ‘disappearance’. The student observes a reaction and sees the loss of a reactant, but does not recognise the formation of a new soluble product.

**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

**How to respond - what next?**

A student who selects option A may benefit from revisiting key concept CSU 1.2: Solutions. Everyday use of the word dissolve can refer to something disappearing, so it is important that students are clear on the scientific meaning of the word. The formation of bubbles is evidence that a chemical reaction is taking place.

A student who opts for B may be referring only to their own everyday perception of an acid as a chemical that eats away at materials. They may need prompting to use their chemistry understanding to come up with a more scientific explanation.

Selection of D indicates that the student is explaining the observations by attributing a change in property (boiling point) of marble which is not scientifically correct.

If students have misunderstandings about how their observations may be explained by the idea of a chemical reaction it may help to write down the symbol equation including state symbols. Encourage the students to match the symbol equation to their observations (see key concept CPS4.1: Representing reactions). The following BEST ‘response activities’ could be used in follow-up to this diagnostic question:

* Soluble products

**Acknowledgments**

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**References**

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