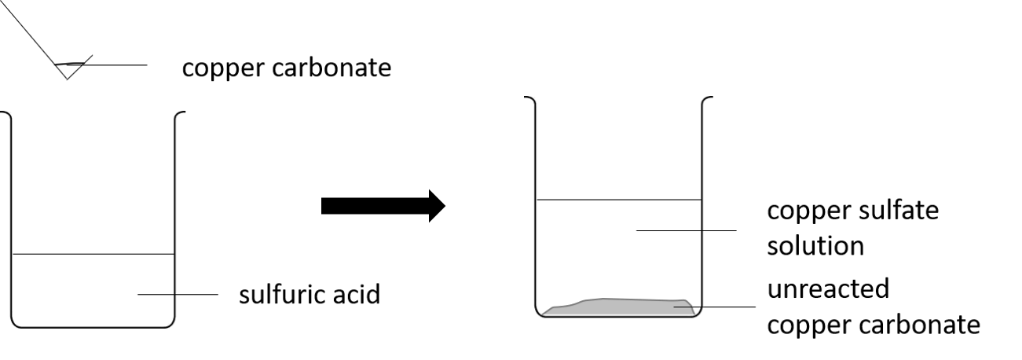
**Final pH**

Some copper carbonate is added to sulfuric acid.

Eventually no more copper carbonate reacts. The excess copper carbonate can be seen at the bottom of the beaker.

**

What is the final pH of the solution?

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** | pH1 |  |  |  |  |
| **B** | pH7 |  |  |  |  |
| **C** | pH12 |  |  |  |  |
| **D** | No pH |  |  |  |  |

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

|  |
| --- |
| **Diagnostic question** |
| **Final pH** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | A salt is formed from a neutralisation reaction between an acid and a base. |
| Observable learning outcome: | Predict the pH at the end of a reaction between an acid and an insoluble base. |
| Question type: | confidence grid |
| Key words: | product, excess, pH, acid |

**What does the research say?**

Driver (1994) refers to research (Hand and Treagust, 1989) that found that a third of students taking part in the study regarded the reaction of acids with either metals or calcium carbonate as examples of ‘acids eating something away’. Other research (Sheppard, 2006) found that some students considered neutralisation to be the physical mixing of an acid and base with no named products.

This type of misunderstanding could lead to confusion for students in terms of predicting the final pH of a neutralisation reaction.

Test questions used by researchers (Demircioğlu, et al. 2005) found that students had misunderstandings about the pH of salts. Some thought that all salt solutions had a pH of 7 whilst others thought that salt solutions do not have a pH at all. The former misunderstanding was thought to arise from students being introduced first to the formation of salts from strong and acids and bases. Salts do not always have to have a pH of 7, for example if the salts have been formed from reaction a strong acid (or base) with a weak base (or acid).

Even if students do correctly predict the final pH to be 7 this may not necessarily be for the correct reasons. For example, Hand and Treagust (1989) also found that some students considered neutralisation to be the breakdown of an acid. This would predict a final pH of 7 but not for scientifically correct reasons.

**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**

Students should be confident that the final pH will be pH7.

**How to respond - what next?**

A student who is confident that the final pH is pH1 may think that there is still acid in the beaker. This suggests a misunderstanding relating to the occurrence of a chemical reaction with the formation of a new product with a different pH.

Confidence in a final pH of 12 may suggest that the student thinks the excess copper carbonate contributes the final pH (but as it is insoluble it does not).

A student who thinks that salts have no pH may have misunderstandings about the concept of pH.

If students have misunderstandings about the final pH it may help for students to think carefully about what the beaker contains at different points during the chemical reaction. The following BEST ‘response activities’ could be used in follow-up to this diagnostic question:

* Response activity: Beaker contents

**Acknowledgments**

Developed by Helen Harden (UYSEG)

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**References**

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