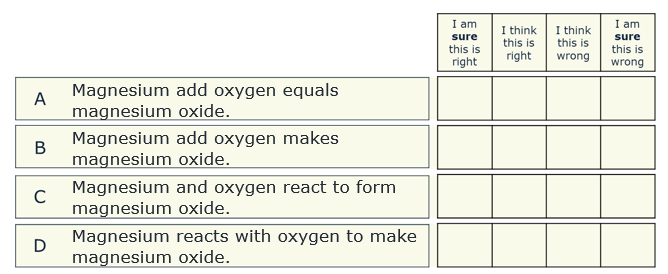
**Word equation sentences**

1. Look at the following word equations.

magnesium +oxygen → magnesium oxide

How could this be written as a sentence?

*Tick the box to show how confident you are that each sentence is right or wrong.*

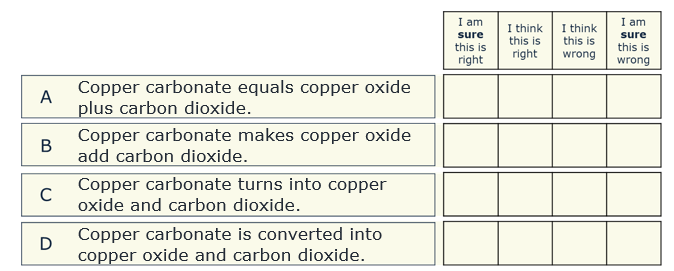


1. Look at the following word equations.

copper carbonate → copper oxide + carbon dioxide

How could this be written as a sentence?

Tick the box to show how confident you are that each sentence is right or wrong.



*Chemistry > Big idea CPS: Particles and structure > Topic CPS4: Understanding reactions > Key concept CPS4.1: Representing reactions*

|  |
| --- |
| **Diagnostic question** |
| **Word equation sentences** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | A chemical reaction can be summarised by a chemical equation. |
| Observable learning outcome: | Interpret the meaning of the symbols + and → in a word equation. |
| Question type: | confidence grid |
| Key words: | word equation |

**What does the research say?**

Research (Al-Kunifed, Good and Wandersee, 1993) was carried out find out whether mathematical and everyday prior knowledge interfered with students’ understanding of basic chemistry concepts. An additional question was asked “Do students differentiate between selected mathematical and chemical concepts that have the same name?”.

The research found that some students believed that the symbol → used in chemical equations had the same meaning as the mathematical sign =. This confusion may result from the use of the word ‘equation’ in both cases. It is worth considering what aspect of a chemical equation does show any equality. Mass is conserved but the nature of the substances on either side are, of course, different.

Interpretation of the + sign varied with some students referring to the mathematical meaning of ‘added’. In terms of the physical carrying out of a chemical reaction this may appear acceptable, but it can lead to misconceptions relating to the nature of the products. The products are new substances with different properties. They do not have properties that are an addition of those of the reactants (Talanquer, 2007). This interpretation of the add sign does not apply to the right-side of a chemical equation, which may also cause confusion.

**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 through 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**

1 C and D are equivalent and correct. A and B use add which is not the chemical meaning of the + sign.

2 D is correct.

**How to respond - what next?**

A student selecting A in answer to question 1 may have confused the meaning of the + with its use in mathematics. In addition, they may be interpreting the → sign as being the same as the = in a mathematical equation. Selection of answer B shows greater understanding of the latter but still misunderstanding about the plus sign.

Selection of answer A for question 2 again shows misunderstanding of the meaning of the → sign. In this question the student is required to understand the + symbol on the right-hand side. Option B incorrectly gives this the same meaning as in mathematics. Option C could be argued to be correct, how every copper carbonate does not itself ‘turn into’ another substance (in the sense of a transmutation).

If students have misunderstandings about the meaning of the + and → sign in a chemical equation it may help to make explicit differences to the mathematical meanings. It may also help to be very careful about the language used when teaching.

**Acknowledgments**

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Images: None

**References**

Al-Kunifed, A., Good, R. and Wandersee, J. (1993). Investigation of high school chemistry students' concepts of chemical symbol, formula and equations: Students' prescientific conceptions. ERIC Document ED376020.

Talanquer, V. (2007). Students' predictions about the sensory properties of chemical compounds: Additive versus emergent frameworks. *Science Education,* 92(1)**,** 96-114.