**Burning magnesium**



1. A small piece of magnesium is held in a Bunsen burner flame.

The magnesium burns with a bright white flame. A chemical reaction takes place.

What other substance does the magnesium react with?

A heat

B air

C oxygen

D fire

**NEVER look directly at the flame.**

1. Which of the following provide evidence that a new substance has formed?

A a white flame

B disappearance of magnesium

C appearance of a white solid

D white smoke

*Chemistry > Big idea CCR: Chemical reactions > Topic CCR1: Chemical change> Key concept CCR1.1: Formation of new substances*

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| **Diagnostic question** |
| **Burning magnesium** |

**Overview**

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| Learning focus: | During a chemical reaction a new substance (or substances) are formed with different properties. |
| Observable learning outcome: | Explain observations of a chemical reaction in terms of the formation of a new substance (or substances). |
| Question type: | simple multiple choice |
| Key words: | substance, chemical change, chemical reaction |

**What does the research say?**

Research (Stavridou and Solomonidou, 1998) investigated how student thinking about chemical reactions develops. Their research showed that initially many students did not understand chemical reactions as changes, rather they considered them to be ‘events’. Their focus was on the most obvious observable feature such as a colour change, gas release or explosion. The idea of the formation of a new substance did appear to develop later.

An article (de Vos and Verdonk, 1985) describes how more ‘spectacular’ reactions may distract students from making observations that provide evidence that a new substance is formed. For example, when magnesium burns with a bright white flame, students may pay attention to the flame and not the white substance (magnesium oxide) that forms as the product.

**Ways to use this question**

This question can be undertaken as a paper and pencil exercise but it is preferable for students to be able to (safely) observe the reaction and more importantly the end product.

**Equipment**

For each student/pair/group:

* small pre- cut piece of magnesium ribbon
* tongs
* Bunsen burner and heat proof mat
* eye protection and filter

**Technician notes**

See CLEAPSS Hazcard for advice including the steps that should be taken to prevent theft of magnesium ribbon. Reels of magnesium should not be left out in the laboratory. It is preferable to provide a limited number of pre-cut lengths of ribbon to be handed out to students.

**Health and safety**

Practical work should be carried out in accordance with local health and safety requirements, guidance from manufacturers and suppliers, and guidance available from CLEAPSS.

Due to the intense white light produced by burning magnesium suitable eye protection must be worn. See up-to-date CLEAPSS Hazcard for guidance on what type of filter is suitable.

You should NEVER look at magnesium directly when it is burning. The magnesium oxide produced will initially be very hot.

**Expected answers**

1C, 2C

**How to respond - what next?**

An answer of option A or D in question 1 indicates that the student has an incorrect understanding of what a substance is and mistakenly classes ‘heat’ or ‘fire’ as a substance. A student that selects option B may be unaware that air is in fact a mixture of substances of which only the oxygen reacts.

A student answering A for question 2 may be focusing on the most dramatic observation of the experiment. Whilst the white flame does provide evidence that a chemical reaction has taken place it does not provide direct evidence for the presence of a new substance. Similarly, the apparent disappearance of magnesium (option B) is a consequence of a chemical reaction but it is the appearance of a new white substance in both solid form (option C) and as particles in white smoke (option D) that is evidence that a new substance has been produced.

If students have misunderstandings about chemical reactions then it may be beneficial, when a new reaction is encountered, to encourage students to identify macroscopic evidence for the formation of a new substance or substances. The following BEST ‘response activities’ could be used in follow-up to this diagnostic question:

* Reacting elements

**Acknowledgments**

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**References**

de Vos, W. and Verdonk, A. H. (1985). A new road to reactions (part 1). *Journal of Chemical Education,* 62(3)**,** 238-240.

Stavridou, H. and Solomonidou, C. (1998). Conceptual reorganization and the construction of the chemical reaction concept during secondary education. *International Journal of Science Education,* 20(2)**,** 205-221.