**Sulfur impurity**

Coal is mostly made up of a combination of carbon and hydrogen atoms.

Coal also contains sulfur impurities (small amounts of sulfur).

1. What are the products of the combustion of coal?

A CO2+ H2O

B CO2 + SO2

C CO2 + H2O+ SO2

*Chemistry > Big idea CCR: Chemical reactions> Topic CCR2: Understanding reactions > Key concept CC2.2: Combustion*

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| **Diagnostic question** |
| **Sulfur impurity** |

**Overview**

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| Learning focus: | During combustion new products are formed from the combination of oxygen with the fuel, resulting in an increase in measured mass. |
| Observable learning outcome: | Explain the products of combustion of a fuel. |
| Question type: | simple multiple choice |
| Key words: | atom, impurity |

**What does the research say?**

Johnston (1991) describes the difficulties of students in switching between macroscopic, sub-microscopic and symbolic levels of thought.

This question requires students to apply sub-microscopic thinking in order to work out that if sulfur atoms are present then there will be an additional product of combustion (sulfur dioxide).

**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.

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.

**Expected answers**

C

**How to respond - what next?**

A student who chooses option A may be simply recalling the products of the combustion of a fuel without considering the reaction in terms of the rearrangement of atoms. Selection of B indicates that the student has recognised that the sulfur atoms present will also combine with oxygen. However, they have not checked that all the reactant atoms have been accounted for as the hydrogen atoms become water (H2O).

If students have misunderstandings about the need for all atoms present in the reactants to be present in the products then it may be helpful to revisit ideas in key concept CPS3.1: Rearrangement of atoms. Students may also benefit from the use of a physical model to illustrate the conservation of atoms.

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

* Burning sulfur

**Acknowledgments**

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Images: None

**References**

Johnstone, A. H. (1991). Why is chemistry difficult to learn? Things are seldom what they seem. *Journal of Computer Assisted Learning,* 7**,** 75-83.