**Sulfur reaction diagram**

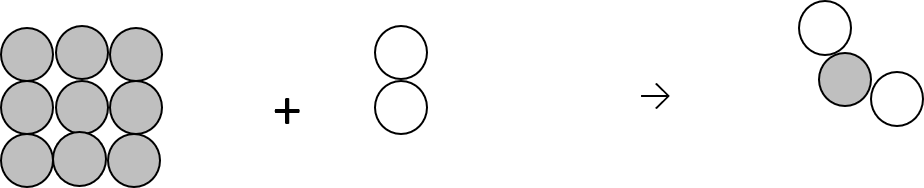
1. Sulfur reacts with oxygen making sulfur dioxide.

The symbolic chemical equation is:

S(s) + O2(g) → SO2 (g)

Copy and complete the particle diagram to show this reaction.

(Just nine atoms of sulfur are shown to make the diagram simpler.)



*Chemistry > Big idea CPS: Particles and structure> Topic CPS4: Understanding reactions > Key concept CP$4.2: Conservation of mass*

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| **Response activity** |
| **Sulfur reaction diagram** |

**Overview**

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| Learning objective: | During a chemical reaction no atoms are created or destroyed. Mass is conserved. |
| Observable learning outcome: | Interpret the quantitative meaning of a chemical equation. |
| Activity type: | diagram completion |
| Key words: | chemical equation |

This activity can help develop students’ understanding by addressing the misunderstandings revealed by the following diagnostic question:

* Interpreting chemical equations

**What does the research say?**

An overview of research into students’ understanding of chemical formulae (Taskin and Bernholt, 2012) describes three different meanings of a chemical symbol. A chemical symbol can represent the element, one atom of the element or the substance itself. A variety of research papers such as (Al-Kunifed, Good and Wandersee, 1993) found that many students assume that a chemical symbol is just an abbreviation for the name of the element and similarly that a chemical formula is shorthand for the name of a compound. From this perspective a symbolic chemical equation is merely a shorter version of the word equation for the reaction.

Reading a chemical equation using the interpretation that a symbol represents one atom of an element can lead to misconceptions regarding ionic compounds where NaCl is regarded as a separate small molecule. Whilst one atom of carbon does go on to form one molecule of carbon dioxide this interpretation misses out an important quantitative feature of a chemical reaction, namely stoichiometry. Rather than telling the reader what happens to one atom of carbon it shows the ratio of carbon atom and oxygen molecules that react.

The meaning of a chemical equation may be made clearer by careful use of language. For example:

“Each atom of carbon reacts with one molecule of oxygen”.

**Ways to use this activity**

This activity aims to support students in switching from a symbolic representation to a sub-microscopic diagram. You may wish to ask students questions such as “Why has sulfur been represented in this way?”. Students could be encouraged to think about prior knowledge relating to the representation of solids using the particle model. Students may also benefit from a reminder that the diagram is not a direct representation of reality and that sulfur has been chosen to be represented by nine atoms so that the diagram is manageable.

*Differentiation*

It may help some students to have access to a physical model of the reaction, for example counters.

**Expected answers**

The completed diagram should include nine oxygen molecules and nine sulfur dioxide molecules.

**Acknowledgments**

Developed by Helen Harden (UYSEG).

Images: Helen Harden

**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.

Taskin, V. and Bernholt, S. (2012). Students' understanding of chemical formulae: A review of empirical research. *International Journal of Science Education,* 36(1)**,** 157-185.