**Reacting elements**

When elements react, they form a compound.

1. Iron reacts with sulfur. This makes iron sulfide.
   * 1. Write down the state and colour of iron, sulfur and iron sulfide in the table below.
     2. Add a tick if the substance is magnetic.

|  |  |  |  |
| --- | --- | --- | --- |
|  | iron | sulfur | iron sulfide |
| state |  |  |  |
| colour |  |  |  |
| magnetic? |  |  |  |

* 1. Now watch the reaction between iron and sulfur.

What evidence can you see that a new substance (iron sulfide) has been made?

1. Sodium reacts with chlorine making sodium chloride.
   1. Write the state and colour of sodium, chlorine and sodium chloride in the table below.

|  |  |  |  |
| --- | --- | --- | --- |
|  | sodium | chlorine | sodium chloride |
| state |  |  |  |
| colour |  |  |  |

* 1. Now watch the reaction between sodium and chlorine.

What evidence can you see that a new substance (sodium chloride) has been made?

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

|  |
| --- |
| **Response activity** |
| **Reacting elements** |

**Overview**

|  |  |
| --- | --- |
| Learning objective: | During a chemical reaction a new substance (or substances) are formed with different properties. |
| Observable learning outcome: | Explain, at a macroscopic level, a reaction in which elements combine. (e.g. oxidation) |
| Activity type: | challenge to thinking - demonstration |
| Key words: | substance, state |

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

* Burning magnesium

**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 pay attention to the flame and not the white substance (magnesium oxide) that forms as the product.

**Ways to use this activity**

Students would benefit from observing real-life samples of the elements and compounds however images could be used as an alternative.

Similarly, it would be preferable for students to be able to observe a demonstration of the two reactions. This would give you the opportunity to explore and extend your students’ understanding through a structured teacher-led discussion.

Carefully selected questions could be used to encourage students to make links between their observations and the idea that a new substance is formed when the elements react.

*Differentiation*

You could challenge different individuals by asking them follow-up questions to clarify or to extend their original answer. If a student is having difficulty with a particular question, it is often helpful to break it into smaller *chunks*, to lead them to a fuller answer. This technique models more thorough answers and can be used to support an open classroom culture in which students are encouraged to ‘have a go’.

**Equipment**

Full details of equipment and materials needed to demonstrate the chemical reactions may be found on the Royal Society of Chemistry’s Learn Chemistry website

Iron and sulfur reaction:

<http://www.rsc.org/learn-chemistry/resource/res00000713/iron-and-sulfur-reaction?cmpid=CMP00005161>

Sodium and chlorine reaction:

<http://www.rsc.org/learn-chemistry/resource/res00000732/heating-group-1-metals-in-air-and-in-chlorine>

An instructional video for teachers that includes the reaction between sodium and chlorine (at 4.39) and between iron and sulfur (at 7.20) may be found at

<http://www.rsc.org/learn-chemistry/resource/res00000713/iron-and-sulfur-reaction#!cmpid=CMP00005162>

**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.

It is important for teachers to practise the demonstrations if they have not carried them out before.

**Expected answers**

1

|  |  |  |  |
| --- | --- | --- | --- |
|  | iron | sulfur | iron sulfide |
| state | solid | solid | solid |
| colour | silver- grey | yellow | black |
| magnetic? | ✓ | X | X |

Evidence: Black solid that is non-magnetic when tested (after cooling).

2

|  |  |  |  |
| --- | --- | --- | --- |
|  | sodium | chlorine | sodium chloride |
| state | solid | gas | solid |
| colour | grey (shiny if cut) | yellow/green | white |

Evidence: White smoke and formation of a white solid.

**Acknowledgments**

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Images: None

**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.