**Which change?**

Here is a list of changes.

|  |  |
| --- | --- |
| **wax melting** | **nail rusting** |
| **wood burning** | **water boiling** |
| **perfume evaporating** | **milk turning sour** |
| **meat cooking in an oven** | **salt added to soup** |
| **sugar added to tea** | **egg boiling** |

Decide whether each change is a **physical change** or a **chemical change.**

Write your answers in the table below.

|  |  |
| --- | --- |
| **Physical changes** | **Chemical changes** |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

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

|  |
| --- |
| **Diagnostic question** |
| **Which change?** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | During a chemical reaction a new substance (or substances) are formed with different properties. |
| Observable learning outcome: | Distinguish examples of physical change from chemical change. |
| Question type: | categorising |
| Key words: | melting, boiling, |

|  |  |
| --- | --- |
| **P** | **PRIOR UNDERSTANDING**  This diagnostic question probes understanding of ideas that are usually taught at age 5-11, to aid transition from earlier stages of learning. |

**What does the research say?**

This diagnostic question was inspired by a task created by Stavridou and Solomonidou (1998). This formed part of research into the conceptual reorganisation that students require in order to understand the concept of chemical reactions. Students were asked to identify examples of chemical reactions from the given list of changes. Students were also asked to write a definition of a chemical reaction. The research found that there was an improvement in the ability to recognise a chemical reaction as students moved through the school.

**Ways to use this question**

The aim of this task is to explore how students set about categorising a series of everyday changes as physical or chemical changes. Students should be familiar with the changes but if they are not, these changes could be omitted.

After completing the task students could be asked to explain how they made their selections.

*Differentiation*

In the original research a similar activity was carried out through student interviews in which the student was presented a series of cards with each change on. These were discussed one by one. If the student was unfamiliar with the change it was rejected. This sort of approach could be adapted to working with an individual or small group of students.

**Expected answers**

|  |  |
| --- | --- |
| **Physical changes** | **Chemical changes** |
| wax melting | wood burning |
| water boiling | nail rusting |
| perfume evaporating | milk turning sour |
| salt added to soup | meat cooking in an oven |
| sugar added to tea | egg boiling |

**How to respond - what next?**

The categorisation of answers will depend upon students’ underlying understanding of what is meant by the term chemical change. Further information on student thinking could be gained by asking students to write down their own definitions of physical change and chemical change.

Even if some students are aware that a chemical change produces new products, some may focus on a requirement for two initial reactants. This may cause them to think that a change with only one starting material (for example milk turning sour) is not a chemical change. Conversely a change with two starting materials (for example sugar and tea) may be regarded as fitting the criteria for a chemical change. Other students may think that the new product may be anything that is different to the starting material. This means that these students would categorise adding sugar to tea or salt to soup as a chemical change.

If students have misconceptions about distinguishing physical or chemical change it may help to consolidate understanding of physical change first by making links with work on changes of state and dissolving (see topic: Substances and mixtures). Understanding of chemical change is more complex as it requires the ability to recognise that the final product substances are different to those at the start. Familiarity with a range of different types of reaction may help with this. The building blocks needed for this understanding are developed through the remaining outcomes of both this progression pathway and other key concepts in the big idea of chemical reactions.

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Images: None

**References**

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.