**Mass change?**

Copper sulfate solution is added to a beaker.

The beaker is placed on a balance. A coil of copper wire is added to the balance.

The total mass is measured.

The coil of copper wire is placed into a solution of silver nitrate.

Silver metal appears.



1. Predict how the mass has changed.

A The mass will increase.

B The mass will stay the same.

C The mass will decrease.

*Chemistry > Big idea CCR: Chemical reactions > Topic CCR2: Understanding reactions > Key concept CCR2.1: Reactions in solution*

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| **Diagnostic question** |
| **Mass change?** |

**Overview**

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| --- | --- |
| Learning focus: | When two solutions react, a product may be insoluble, resulting in the formation of a precipitate. |
| Observable learning outcome: | Predict the conservation of mass during a displacement or precipitation reaction. |
| Question type: | simple multiple choice |
| Key words: | solution, mass |

**What does the research say?**

Research (Andersson, 1990) suggests that student answers to a research question asking students to predict the mass after a chemical reaction are influenced by their conceptions of chemical change.

For example, if a student observes that a substance ‘disappears’ they may predict that the mass will decrease. If the appearance of a product is explained as the product having always been present but that it has moved and become visible, then students may correctly predict conservation of mass (although for incorrect reasons).

Answers to the question were also affected by student understanding of mass and weight. Some student claimed that smoke did not weigh anything. Other students thought that a gas had no mass which suggests that they may not recognise a gas as a substance.

**Ways to use this question**

As described above, it is important to understand students’ reason for their predictions. For this reason, you may wish to add a follow up question “Explain why you made this prediction”.

This will help to identify any students who choose the correct answer but for the wrong reasons.

Student may benefit from watching a demonstration of this reaction. The experiment can be carried out using a coil of copper wire as shown in the question or it may be carried out at microscale with copper wire being placed in a drop of silver nitrate solution.

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

**Expected answers**

B

**How to respond - what next?**

A student who selects option A may link the apparent appearance of silver to an increase in mass. There is not a conspicuous ‘disappearance’ of a substance during this reaction (although the copper is gradually converted to copper nitrate) so students are unlikely to predict a loss of mass.

If students have misconceptions about the conservation of mass during a chemical reaction, it may help to consider reactions at the particle level. See key concept CPS3.1: Rearrangement of atoms and key concept CPS4.1: Representing reactions.

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

* Predicting mass

**Acknowledgments**

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**References**

Andersson, B. (1990). Pupils' conceptions of matter and its transformations (age 12-16). *Studies in Science Education,* 18**,** 53-85.