**Precipitate**

Colourless potassium iodide solution is poured into a test tube containing colourless lead nitrate solution.



yellow precipitate

1. Explain the appearance of a yellow precipitate.

A An insoluble product forms a suspension.

B The potassium iodide turns the lead nitrate yellow.

C A new yellow substance is made.

D One of the products is insoluble and yellow.

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

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| **Diagnostic question** |
| **Precipitate** |

**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: | Explain the appearance of a precipitate in terms of the formation of an insoluble product. |
| Question type: | confidence grid |
| Key words: | solution, colourless, precipitate, product, suspension, substance |

**What does the research say?**

This question builds on the diagnostic question ‘Colour change’ in key concept CCR1.1: Formation of new substance. This was inspired by an article by de Vos and Verdonk (1985). The exemplar reaction in that question was a solid-solid reaction between lead nitrate and potassium iodide. The focus was on the formation of a new substance with different observable properties (colour).

In order to explain the formation of a precipitate students must recognise the formation of a new insoluble substance from the reaction between two soluble substances in solution.

**Ways to use this question**

Students should complete the confidence grid 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.

*Differentiation*

Ensure that all students understand that the question is asking them to decide which statements are correct in terms of explaining the formation of a precipitate.

**Equipment**

Instructions for a microscale precipitation experiment suitable for students “Lead compounds- precipitation reactions and pigments” may be found at <http://www.rsc.org/learn-chemistry>

This includes a range of precipitation reactions of lead nitrate and appropriate safety advice.

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 is wrong.

A is correct and explains the formation of the solid precipitate, but not the colour.

C explains the formation of a yellow product but not the creation of a precipitate.

D explains both the formation of a yellow product and why the precipitate forms (the yellow product is insoluble).

**How to respond - what next?**

Confidence that B is right indicates that a student may be insecure in their understanding of chemical change and the formation of a new substance.

If students have misunderstandings about why a precipitate forms, students may benefit observing again what happens when a soluble and insoluble substance are added to water. This may help to reinforce that an insoluble substance in powdered form creates a suspension. They should then be encouraged to make connections to the key concept of chemical change (CCR1) and the formation of a new substance with different properties.

If students have difficulty in understanding that the reactants are in solution an alternative microscale experiment could be carried out in which small quantities of the solid reactants are added on either side of a small ‘puddle’ of water. The reactants dissolve and gradually diffuse, resulting in the formation of a precipitate where they meet.

See <http://science.cleapss.org.uk/Resource-Info/Precipitates-Diffusing.aspx>

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

* Solubility sentences

**Acknowledgments**

Developed by Helen Harden (UYSEG).

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**References**

de Vos, W. and Verdonk, A. H. (1985). A new road to reactions (part 1). *Journal of Chemical Education,* 62(3)**,** 238-240.