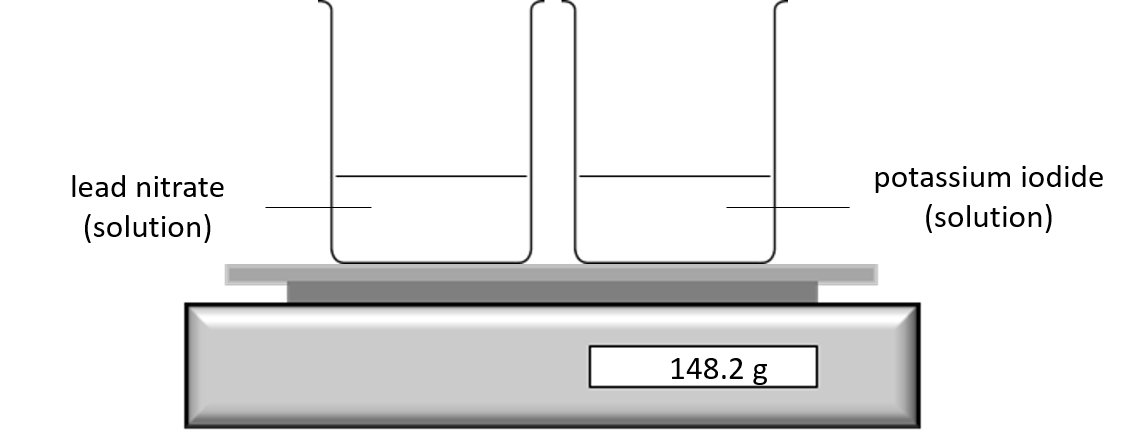
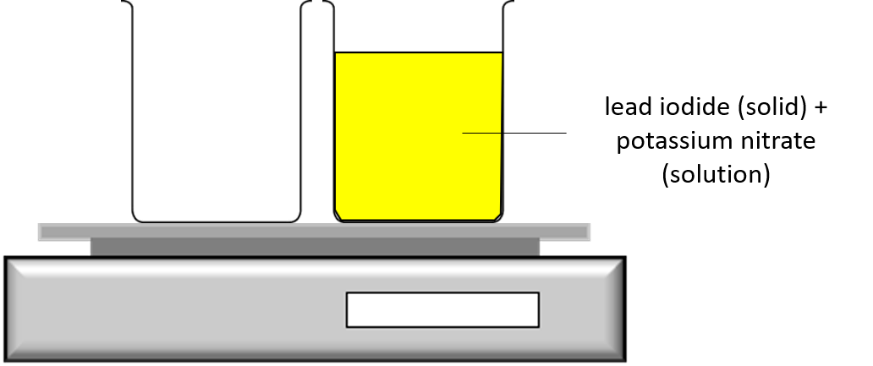
**What mass?**

The reactants are placed on a balance. The total mass is 148.2g.



The reactants are mixed. A yellow precipitate forms.



1. What is the mass of the products?

A 144.5g

B 150.2g

C 148.2g

*Chemistry > Big idea CPS: Particles and structure > Topic CPS4: Understanding reactions > Key concept CPS4.2: Conservation of mass*

|  |
| --- |
| **Diagnostic question** |
| **What mass?** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | During a chemical reaction no atoms are created or destroyed. Mass is conserved. |
| Observable learning outcome: | Predict and explain conservation of mass during a chemical reaction. |
| Question type: | simple multiple choice |
| Key words: | reactant, product, chemical reaction, mass |

**What does the research say?**

A question used during research by Barker and Millar (1999) asked students to predict whether the mass of two solutions mixed together to form a precipitate would change. Student explanations for their answers revealed a number of misunderstandings.

Some students predicted that the mass would increase because a solid “weighs more” than a liquid. Others predicted that the mass would decrease because a gas is produced. It appeared that the evolution of a gas was something they associated with any chemical reaction.

Students who correctly predicted no change in mass did not always do so for the correct scientific reason. Some made this prediction on the basis that no reaction had taken place.

**Ways to use this question**

Students should complete the question 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.

*Differentiation*

It may help students to observe a demonstration of the actual experiment.

Practical work should be carried out in accordance with local health and safety requirements, guidance from manufacturers and suppliers, and guidance available from CLEAPSS. In particular care should be taken with lead nitrate and all safety advice followed (including to wash hands after use).

**Expected answers**

C

**How to respond - what next?**

A student opting for answer B could hold some misunderstandings about their macroscopic observation. Further questioning could reveal why a student chose this answer. For example, a student could think that the precipitate has greater mass than a solution because it ‘contains a solid’

Option A is less likely to be chosen but selection could indicate a wider misunderstanding that chemical reactions always produce a gas.

If students have misunderstandings about conservation of mass during a chemical reaction, they could be encouraged to think about what is happening macroscopically (nothing has been added or lost) and sub-microscopically (no new atoms have been created or destroyed).

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

* Product mass

**Acknowledgments**

Developed by Helen Harden (UYSEG),from an idea by Vanessa Barker and Robin Millar (1999).

Images: Helen Harden and Alistair Moore

**References**

Barker, V. and Millar, R. (1999). Students' reasoning about chemical reactions: what changes occur during a context-based post-16 chemistry course? *International Journal of Science Education,* 21(6)**,** 645-665.