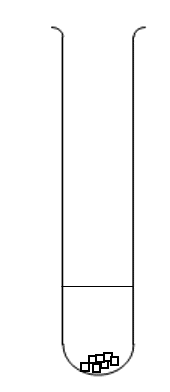
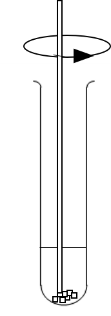
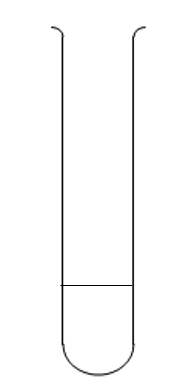
**Stirring**

Some sugar is added to water.

A small amount of sugar does not The mixture is stirred. All the sugar dissolves.

dissolve straight away.

1. What has happened to the solubility of the sugar?

Put a tick (✓) in the box next to the best answer.

|  |  |  |
| --- | --- | --- |
| **A** | The solubility of the sugar has **increased**. |  |
|  |  |  |
| **B** | The solubility of the sugar has **stayed the same**. |  |
|  |  |  |

1. Why is this?

Put a tick (✓) in the box next to the best answer.

|  |  |  |
| --- | --- | --- |
| **A** | All the sugar would have dissolved if left. |  |
|  |  |  |
| **B** | The stirring is what makes dissolving happen. |  |
|  |  |  |
| **C** | Stirring increases the amount of sugar that dissolves. |  |
|  |  |  |

*Chemistry > Big idea CSU: Substance > Topic CSU2: Solubility > Key concept CSU2.1: Comparing solubility*

|  |
| --- |
| **Diagnostic question** |
| **Stirring** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | Solubility is a property of a substance that varies with temperature. |
| Observable learning outcome: | Recognise that stirring does not affect the solubility of a substance. |
| Question type: | Diagnostic, two-tier multiple choice |
| Key words: | dissolve, solubility |

|  |  |
| --- | --- |
| **P** | **PRIOR UNDERSTANDING**  This diagnostic question probes understanding of ideas from an earlier key concept, to aid transition from previous stages of learning. |

**What does the research say?**

A review of solution chemistry studies (Çalýk, Ayas and Ebenezer, 2005) gives an example of how an everyday experience can lead to a misunderstanding. When a spoonful of sugar is added to tea, stirring the tea decreases the time taken for dissolving to occur. However, what is experienced by the maker of the cup of tea is a decrease in the amount of sugar left at the bottom of the cup. Therefore, students may conclude that stirring increases the amount of solute that dissolves in the cup of tea. They may then incorrectly infer that stirring increases the solubility of a substance.

The review also cited research that found that students paid attention to the mechanical processes such as stirring or shaking apparently used to dissolve a substance. These observations led some students to believe that dissolving could not take place without mechanical intervention.

**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.

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*

You may choose to demonstrate and talk through the experiment to ensure that all students understand the description in the question.

**Expected answers**

1B, 2A

**How to respond - what next?**

A student who opts for answer A may have misunderstandings about the role of stirring in dissolving and therefore select reason C (that stirring increases the amount of sugar that dissolves).

A student who selects the correct answer to question 1 (B), may not necessarily do so for the correct reason. For example, reason B in question 2 indicates the misunderstanding that stirring is necessary for dissolving. The correct reason is A. The sugar would have dissolved eventually if left. Stirring increases how fast sugar dissolves but not how much dissolves.

If students have misunderstandings about the role of stirring in dissolving it may help to revisit ideas from key concept CPS1.2: Particles in solution. In particular, you may wish to reinforce the idea that stirring is not required for dissolving. Dissolving takes place without stirring, albeit very slowly in some cases. Stirring therefore does not increase the amount of solute that dissolves, just how fast this happens. This could be demonstrated by adding an appropriate mass of sugar to a beaker of water and leaving for a length of time without stirring.

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

* Blue crystals (CPS2.1)

**Acknowledgments**

Developed by Helen Harden (UYSEG).

Images: Helen Harden and Alistair Moore (UYSEG)

**References**

Çalýk, M., Ayas, A., and Ebenezer, J. V. (2005). A review of solution chemistry studies: Insights into students' conceptions. *Journal of Science Education and Technology,* 14(1)**,** 29-50.