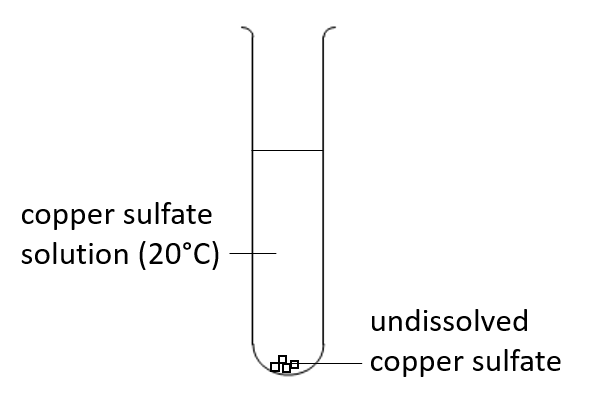
**Warming up and cooling down**

Some copper sulfate is added to a test tube of water at 20°C.



Not all the copper sulfate dissolves.

The test tube is warmed until the copper sulfate solution is 40°C. All the copper sulfate dissolved.

The copper sulfate solution is allowed to cool back to 20°C.

What do you expect to observe?

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

|  |  |  |
| --- | --- | --- |
| **A** | Less undissolved copper sulfate than at the start. |  |
|  |  |  |
| **B** | The same amount of undissolved copper sulfate as at the start. |  |
|  |  |  |
| **C** | More undissolved copper sulfate than the start. |  |
|  |  |  |
| **D** | No undissolved copper sulfate. |  |
|  |  |  |

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

|  |
| --- |
| **Response activity** |
| **Warming up and cooling down** |

**Overview**

|  |  |
| --- | --- |
| Learning objective: | Solubility is a property of a substance that varies with temperature. |
| Observable learning outcome: | Predict observable changes following the cooling of a saturated solution. |
| Activity type: | Response, application and practice |
| Key words: | dissolve, solution |

This activity can help develop students’ understanding by addressing the misunderstandings revealed by the following diagnostic question:

* Cooling down

**What does the research say?**

A study (Uzuntiryaki and Geban, 2005) investigated the impact of a conceptual change approach to understanding concepts relating to solutions. One of the concepts they tested was an understanding of what happens to a solution if it is cooled. In the control group who had received no specific input to correct misconceptions 30% of students thought that solution would remain the same when cooled. They did not recognise that at a lower temperature the solute would recrystallise because the mass of substance dissolved in a particular volume of solution is related to the temperature of the solution.

**Ways to use this activity**

This activity gives students the opportunity to practise applying their understanding and to clarify their thinking through discussion. To support this, students should answer the question in pairs or small groups.

Listening to individual groups as they work often highlights any difficulties they might have. These can often be overcome, through a whole class clarification or redirection part way through the activity.

If students do not recognise that the solubility of the copper sulfate at the start is the same as when it cools back to 20°C, then you may also wish to refer to the data in response activity ‘Copper sulfate data’.

*Differentiation*

If some students are working with a teaching assistant, then a list of prompt questions for the teaching assistant could help to make this activity more purposeful.

**Expected answers**

B

**Acknowledgments**

Developed by Helen Harden (UYSEG).

Images: Helen Harden and Alistair Moore

**References**

Uzuntiryaki, E. and Geban, O. (2005). Effect of conceptual change approach accompanied with concept mapping on understanding of solution concepts. *Instructional Science,* 33**,** 311-339.