**What’s the magnification?**



objective lens

eyepiece lens

A student uses the microscope to look at cells on a slide.

* The eyepiece lens has a magnification of 10x
* The objective lens has a magnification of 4x

What is the magnification of the cells seen using the microscope?

|  |  |
| --- | --- |
| **A** | 4x |
| **B** | 10x |
| **C** | 14x |
| **D** | 40x |

*Biology > Big idea BCL: The cellular basis of life > Topic BCL1: Cells > Key concept BCL1.3: Cell shape and size*

|  |
| --- |
| **Diagnostic question** |
| **What’s the magnification?** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | Cells are usually too small to be seen without a microscope, but have a range of three-dimensional shapes and sizes. |
| Observable learning outcome: | Recall that most (but not all) cells are too small to be seen without a microscope. |
| Question type: | Simple multiple choice |
| Key words: | cell, microscope |

**What does the research say?**

A number of researchers have reported that children aged 11-16 lack an appreciation of size and scale, and that this impacts their understanding of the relative sizes of cells and other biological structures (e.g. Arnold, 1983; Dreyfus and Jungwirth, 1988; Driver et al., 1994).

Dreyfus and Jungwirth (1989) acknowledge that the cell is, when first introduced, an abstract concept. When introducing ideas about cells, several sources advocate starting with hands-on light microscopy of cells from a range of tissues and organisms, to enable students to build their own understanding of the size of cells and what they look like (AAAS Project 2061, 2009; Skinner, 2011).

**Ways to use this question**

Students should complete the question individually. This could be a pencil and paper exercise, or you could use the PowerPoint presentation with an electronic voting system or mini white boards. A light microscope could be set up with a sample of cells mounted on a slide for students to observe. The numbers stated in the question could be changed to match the available microscope.

The answers to the question will indicate whether students know how to calculate the magnification of the structures observed when using a light microscope, and give an indication of whether they appreciate how many times bigger the cells appear when observed this way.

*Differentiation*

You may choose to read the question to the class, so that everyone can focus on the science. In some situations it may be more appropriate for a teaching assistant to read for one or two students.

**Expected answers**

**D** 40x

**How to respond - what next?**

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.

A good response to finding a misunderstanding could be to teach the idea to the class and then give the students an activity in which they can practise using the concept so that they can consolidate their understanding. The response activity ‘What is it made of?’ from key concept BCL1.2 *Cells and cell structures* could be used in this way in response to this diagnostic question, as it guides students through the process of using a light microscope to observe cells from a range of tissues and organisms.

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Images: UYSEG

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