**Seeing atoms**

A microscope on a table

Description automatically generatedIs it possible to see atoms?

For each statement, tick (✓) **one** column to show what you think*.*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | I am **sure** this is right | I think this is right | I think this is wrong | I am **sure** this is wrong |
| **A** | Atoms can be observed with a school microscope. |  |  |  |  |
| **B** | Atoms can be observed with a powerful microscope. |  |  |  |  |
| **C** | Scientists have observed atoms using other equipment. |  |  |  |  |

*Chemistry > Big idea CPS: Particles and structure > Topic CPS6: Periodic Table > Key concept CPS6.1: Atomic structure*

|  |
| --- |
| **Diagnostic question** |
| **Seeing atoms?** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | The structure of an atom may be represented by an atomic model. |
| Observable learning outcome: | Recognise that atoms are not visible under any type of microscope and that scientists have never ‘seen’ the structure of an atom. |
| Question type: | confidence grid |
| Key words: | atom, microscope |

**What does the research say?**

A research study (Harrison and Treagust, 1996) interviewed students about their mental models of atoms. A majority of respondents stated that atoms are visible under a powerful microscope. Well over half thought that scientists could see, or have seen, atoms.

Driver et al (1994) cites research (Arnold, 1983) that found that students confused the concept of a cell and a molecule. Instead they appeared to have a more generalised concept of ‘very small units that make up larger things.’ Arnold called this a ‘molecell’.

This could explain why so many students considered that atoms would be visible under a powerful microscope.

Alternatively, students may have seen images produced by a scanning tunnelling electron micrograph. However, this equipment shows the contour of the electric potential for the outermost layers of the electron orbitals. This is in effect a model generated by a computer, not an actual observation of an atom.

**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*

Some students may benefit from support in structuring their thinking about each statement.

**Expected answers**

Students should be confident that none of the statements is correct.

**How to respond - what next?**

A student who agrees with the statement that atoms are observable under a standard microscope may be unclear as to the relative size of an atom in comparison with microscopically observable objects.

If a student believes that scientists have seen atoms, then they may be more likely to think that a diagram of an atomic model actually shows a representation of real life. Careful clarification and discussion of the nature of a model may be needed when introducing the structure of the atom.

If students have misunderstandings about the size of an atom it may help to compare the size of the atom to other very small, but microscopically observable items such as a cell. The following BEST ‘response activities’ could be used in follow-up to this diagnostic question:

* Size sequence

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Images: Pixabay

**References**

Arnold, B. (1983). Beware the molecell! *Biology Newsletter,* 42**,** 2-6.

Driver, R., et al. (1994). *Making Sense of Secondary Science: Research into Children's Ideas,* London, UK: Routledge.

Harrison, A. G. and Treagust, D. F. (1996). Secondary students' mental models of atoms and moelcules: Implications for teaching chemistry. *Science Education,* 80(5)**,** 509-534.