**Relative size**

The nucleus of an atom is drawn with a diameter of 1cm (0.01m).

A close up of a logo

Description automatically generated

On a scale drawing, approximately what is the diameter of the whole atom?

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

|  |  |  |
| --- | --- | --- |
| **A** | 10cm (0.1 m) |  |
|  |  |  |
| **B** | 1 m |  |
|  |  |  |
| **C** | 100 m |  |
|  |  |  |
| **D** | 1000 m |  |
|  |  |  |

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

|  |
| --- |
| **Diagnostic question** |
| **Relative size** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | The structure of an atom may be represented by an atomic model. |
| Observable learning outcome: | Recognise that a typical diagram of atomic structure is not drawn to scale. |
| Question type: | simple multiple choice |
| Key words: | nucleus, atom, diameter |

**What does the research say?**

Research (Harrison and Treagust, 1996) into students’ mental models of atoms, found that even though some students stated that an atom is mostly space, they did not convey this through their diagrams. However, the authors also note that this is not surprising as textbook diagrams of the atom are not typically drawn to scale.

**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.

The answers to the question will show you whether students understood the concept sufficiently well to apply it correctly.

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 need an explanation of what is meant by ‘drawn to scale’.

**Expected answers**

The diameter of an atom is approximately 100,000 greater than that of a nucleus.

1cm = 0.01m

0.01 x 100,000 = 1000m (Option D)

**How to respond - what next?**

A student who selects option A (10cm) may think that textbook diagrams are drawn to scale. Selection of options B or C indicates that students may not be aware of the approximate multiplication factor between the size of an atomic nucleus and the diameter of the whole atom.

If students have misunderstandings about the relative size of the nucleus and the whole atom it may help to explain the diagrams that students are familiar with are not drawn to scale (in order to fit on the page).

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

* Stadium model

**Acknowledgments**

Developed by Helen Harden (UYSEG), from an idea by Allan Harrison and David Treagust (Science and Mathematics Education Centre, Curtin University of Technology, Perth, Australia.

Images: Helen Harden (UYSEG)

**References**

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.