**Size sequence**

Arrange the following in order of size, starting with the smallest

|  |  |
| --- | --- |
| Cards for  **Size sequence** |  |
| **atomic nucleus** | **DNA (genetic material)** |
| **water molecule** | **atom** |
| **proton** | **cell nucleus** |
| **cheek cell** | **nerve cell** |

*Chemistry > Big idea CPS: Particles and structure > Topic CPS6: Periodic table > Key concept CP6.1: Atomic model*

|  |
| --- |
| **Response activity** |
| **Size sequence** |

**Overview**

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| --- | --- |
| Learning objective: | 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. |
| Activity type: | sequencing |
| Key words: | atom, nucleus, proton, electron, cell, molecule |

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

* Atom observation

**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 ‘mole cell’.

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 activity**

This task is intended for discussion in pairs or small groups. Listening in on the groups may help to indicate where further guidance is necessary in terms of overcoming misunderstandings about the relative sizes of the items listed on the cards,

Feedback from each group can be used to support student thinking when considering the relative size of objects not visible to the naked eye.

*Differentiation*

Some students could be encouraged to include biological molecules such as glucose of starch in their sequence.

**Expected answers**

proton, atomic nucleus, water molecule, DNA (genetic material), cell nucleus, cheek cell, nerve cell

**Acknowledgments**

Developed by Helen Harden (UYSEG).

Images: None

**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.