**Comparing models**

A helium atom may be represented using the particle model and the atomic model.

**Particle model**  **Atomic model** A picture containing electronics

Description automatically generated



Some students compare the two different models.

Who do you agree with and why?

**Arush:** The particle model can be used to explain some things that the atomic model cannot.

**Ryan:** The particle model is wrong because atoms are actually made of protons, neutrons and electrons.

**Aaron:** The atomic model does not show what an atom actually looks like, but it is better because it can explain more things.

**Noah:** The atomic model is better because it shows what a helium atom actually looks like very close-up.

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

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| **Diagnostic question** |
| **Comparing models** |

**Overview**

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| Learning focus: | The structure of an atom may be represented by an atomic model. |
| Observable learning outcome: | Compare the particle and atomic models. |
| Question type: | Confidence grid |
| Key words: | particle model, atomic model |

**What does the research say?**

A research project (Harrison and Treagust, 1996) categorised student responses about their mental models of an atom using three levels of modelling ability originally described by Grosslight et al. (1991). At a basic level the student accepts that some real attributes are missing from the model but basically regards the model as having a one to one correspondence to reality. As student understanding of models increases a student may recognise that the model has a specific purpose and that the model has been constructed to fulfil this. However, the student still focuses on the reality shown by the model rather than the ideas that it represents. At the most advanced level the student understands that the model aids the development and testing of ideas and is not a representation of reality. The student will also be confident in constructing and manipulating diverse and multiple models.

**Ways to use this question**

This task is intended for discussion in pairs or small groups. It can be done as a pencil and paper exercise or projected onto a screen.

Students should read the statements and follow the instructions on either the worksheet or the PowerPoint. Listening in to the conversations of each group will often give you insights into how your students are thinking. Each member of a group should be able to report back to the class.

Feedback from each group can be used, with careful teacher questioning, to bring out a clear description or explanation of the science.

*Differentiation*

The quality of the discussions can be improved with a careful selection of groups; or by allocating specific roles to students in each group. For example, you may choose to select a student with strong prior knowledge as the scribe. They may question the others and only write down what they have been told. This strategy encourages contributions from more members of each group.

NB in any class, small group discussions typically improve over time and a persistence with this strategy is often very successful in the medium to long term.

**Expected answers**

A student who agrees with Aaron is demonstrating an understanding that a model is not a direct reflection of reality. Agreement with Arush shows recognition that a model has a purpose and that in some cases a simpler model may provide a clearer explanation.

**How to respond - what next?**

A student who agrees with Ryan or Noah may be working at a more basic level with models as both these answers imply that the quality of a model depends upon its closeness to reality.

If students have misunderstandings about the use of more than one model to provide explanations it may help students to consider example of what the particle model and atomic model can be used to explain. The following BEST ‘response activities’ could be used in follow-up to this diagnostic question:

* Model explanations

**Acknowledgments**

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Images: Clker Free Vector Images via Pixabay and Helen Harden

**References**

Grosslight , L., et al. (1991). Understanding models and their use in science: Conceptions of middle and high school students and experts. *Journal of Research in Science Teaching,* 28**,** 799-822.

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