**Model explanations**

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



1. Which model would you use to explain each of the following and why?
   1. A helium atom has no overall charge.
   2. Helium is in the gas state at room temperature.
   3. Helium is a light element.

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

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| **Response activity** |
| **Model explanations** |

**Overview**

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| Learning objective: | The structure of an atom may be represented by an atomic model. |
| Observable learning outcome: | Compare the particle and atomic models. |
| Activity type: | Critiquing a representation |
| Key words: | particle model, atomic model |

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

* Comparing models

**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 activity**

Students should complete this activity in pairs or small groups, and the focus should be on the discussions. It is through the discussions that students can check their understanding and rehearse their explanations.

Philosophically science can be said to be a description of the ‘best model’ we have for the world. In this activity students should compare ways which two particular model provide explanations of the real world.

Students should work together to follow the instructions on either the worksheet or the PowerPoint. Giving each group one worksheet to complete between them is helpful for encouraging discussion, but each member should be able to report back to the class. Listening in to the conversations of each group will often give you insights into how your students are thinking.

*Differentiation*

Some students may need support in thinking about what a model needs to show in order to explain each observation.

**Expected answers**

Helium has no overall charge.

The atomic model, which shows an equal number of positive protons and negative electrons can explain this.

Helium is in the gas state at room temperature.

This may be explained using the particle model. If the forces of attraction between atoms is small, then even at room temperature the atoms will be separate meaning that the helium is in the gas state.

Helium is a light element.

The mass of an atom is due to the nucleus. So, the relative mass of different elements may be explained by the atomic model.

**Acknowledgments**

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Images: None

**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.