**Properties of copper**



Copper is malleable. It can be hammered into shape.

1. Select the statement that best explains this property.

A Copper atoms are soft and can be easily squashed.

B There are no forces of attraction between the copper atoms.

C The copper atoms can be made to slide across each other.

D Copper atoms can be flattened if hit hard enough.

*Chemistry > Big idea CPS: Particles and structure > Topic CPS2: Elements and compounds > Key concept CPS2.1: Atoms and molecules*

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| **Diagnostic question** |
| **Properties of copper** |

**Overview**

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| Learning focus: | The properties of elements and compounds arise from the structural arrangement of their constituent atoms. |
| Observable learning outcome: | Link the properties of an element to the collective behaviour its atoms. |
| Question type: | simple multiple choice |
| Key words: | atom, property, malleable |

**What does the research say?**

A research project investigated student perceptions of atoms, including any misunderstandings about the atom being a ‘piece of the matter’ that has the macroscopic properties of the substance. This question was inspired by the title of the research article “Is an atom of copper malleable?” (Ben-Zvi, 1986).

More recent research suggests that the fundamental sources of many students’ difficulties in chemistry is a failure to understand the emergent nature properties of chemical substances and their interactions. It is therefore recommended that the concept that properties emerge from the collective arrangement of atoms that make up a substance should be taken into account when addressing students’ misunderstandings (Tümay, 2016).

**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.

*Differentiation*

It may assist some students to explain more carefully what is meant by the word ‘malleable’. A video clip could be used to show a metal being hammered into shape.

**Expected answers**

C

**How to respond - what next?**

Selection of option A or D suggests that a student still considers atoms to have the macroscopic properties of the bulk material. Option C suggests that the student does not recognise the need for forces of attraction to hold the copper atoms together in the solid state.

If students have misunderstandings about the properties of substances arising from the collective arrangement of atoms it may help them to be made explicitly aware of the common misunderstanding that atoms have the macroscopic properties of the substance. Students could then be encouraged to predict the wrong answer that students are likely to give.

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

* Property mistakes

**Acknowledgments**

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Images: Copper pot by Momentmal via Pixabay <https://pixabay.com/en/boiler-copper-boiler-copper-shiny-2630690/>

**References**

Ben-Zvi, R. (1986). Is an atom of copper malleable? *Journal of Chemical Education,* 63(1)**,** 64-66.

Tümay, H. (2016). Reconsidering learning difficulties and misconceptions in chemistry:emergence in chemistry and its implications for chemical education. *Chemistry Education Research and Practice,* 17**,** 229-245.