**Molecules or giant structure?**

A picture containing sitting, table

Description automatically generatedSome compounds are made up of separate small molecules.

A picture containing indoor, lined, sitting, table

Description automatically generatedOther molecules are made up of a giant structure.

1. Look at the list of formulae below.
   1. For each formula state whether the compound is made of **separate molecules** or a **giant structure**. Explain how you decided each answer.
      1. CO2
      2. MgO
      3. MgCl2
      4. CO
   2. If you were unsure about any formula, explain what extra information would have helped you to answer.

*Chemistry > Big idea CPS: Particles and structure > Topic CPS8: Ionic bonding > Key concept CPS8.2: Ionic lattice*

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| --- |
| **Response activity** |
| **Molecules or giant structure?** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | Ionic bonding occurs due to the electrostatic attraction between oppositely charged ions in an ionic lattice. |
| Observable learning outcome: | Interpret an ionic formula as representing the ratio of ions. |
| Activity type: | Application and practice |
| Key words: | ion |

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

* NaCl

|  |  |
| --- | --- |
| **P** | **PRIOR UNDERSTANDING**  This activity explores ideas that are usually taught at age 11-14, to aid transition from earlier stages of learning. |

**What does the research say?**

One paper on student conceptions of ionic bonding (Taber, Tsaparlis and Nakiboğlu, 2012) comments that within a few years of being introduced to a basic particle theory, students are often expected to learn about ions and molecules and understand their role as components of substances, even though other research (Johnson, 1998) suggests that understanding of the basic particle model may only develop over an extended period of time.

As part of a review of the empirical research (Taskin and Bernholt, 2012) on student understanding of chemical formulae, the authors cite their own project in which students were asked to match diagrams to different chemical formulae. The majority of students were found to be able to choose the correct diagram when the chemical formula represented as substance made up of individual molecules. However, when presented with the chemical formula of a substance with a giant structure (such as an ionic compound) most students still selected a diagram representing a molecular compound.

**Ways to use this activity**

This activity gives students the opportunity to practise applying their understanding to some other compounds and to clarify their thinking through discussion. To support this, students should answer the question in pairs or small groups.

Listening to individual groups as they work often highlights any difficulties they might have.

Asking students to share their answers is a useful check. Encourage students to discuss how they decided their answers. Also discuss whether any compounds were more difficult to decide than others and what other information would have helped, and why.

*Differentiation*

If some students are working with a teaching assistant, then a list of prompt questions for the teaching assistant could help to make this activity more purposeful.

**Expected answers**

**ai** separate molecules

**ii** giant structure

**iii** giant structure

**iv** separate molecules

**b** It may help students to know whether the compound is in the gas or solid state at room temperature.

**Acknowledgments**

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**References**

Johnson, P. (1998). Progression in children's understanding of the basic particle theory:a longitudinal study. *International Journal of Science Education,* 20(4)**,** 393-492.

Taber, K. S., Tsaparlis, G. and Nakibo ğlu, C. (2012). Student conceptions of ionic bonding: Patterns of thinking across three European contexts. *Internationl Journal of Science Education,* 34(18)**,** 2843-2873.

Taskin, V. and Bernholt, S. (2012). Students' understanding of chemical formulae: A review of empirical research. *International Journal of Science Education,* 36(1)**,** 157-185.