**Polymer chain**

Some students are making a model of a polymer molecule.

A picture containing cable, sitting, pile, blue

Description automatically generated

They have decided to use a long chain of beads.

1. State one way in which a chain of beads **is a good representation** of a polymer molecule.
2. State three ways in which a chain of beads **is not an accurate representation** of a polymer molecule.

*Chemistry > Big idea CMS: Materials science > Topic CMS2: Designing materials > Key concept CMS2.1: Polymer properties*

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| **Response activity** |
| **Polymer chain** |

**Overview**

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| Learning objective: | Materials scientists can design polymers with specific properties. |
| Observable learning outcome: | Recognise that a polymer molecule can be made up of thousands of atoms. |
| Activity type: | critiquing a representation |
| Key words: | atom, polymer, molecule |

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

* Molecule size

**What does the research say?**

Johnstone (1991) explains the difficulties that many students face in understanding science as the degree of ‘multilevel’ thought required. In chemistry students are frequently required to think about very different types of thing all at once.

Johnstone presented this in the form of a triangle:



*(after Johnstone, 1991, p78)*

Students will be familiar with polymers, at a macroscopic level, from everyday life but their mental models of the sub-microscopic structure of polymers may be very different to the actual structure of a polymer. In particular, students may not realise that polymers are made up of vastly more atoms than the smaller molecules that they may have been introduced to so far. Carbon dioxide is made up of three atoms, whereas a polymer may be made up of tens of thousands of atoms.

**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 identify ways in which this particular model is a good representation of the real world, and ways in which it is not.

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*

You may choose to use simplified worksheets for some students, for example with gaps to fill in so they can focus on the science. In some situations, it may be more appropriate for a teaching assistant to read and/or scribe for one or two students.

**Equipment**

For the class:

* A string of beads

**Expected answers**

A chain of beads is a good representation of a polymer because it shows lots of beads (atoms) joined in a long chain.

It is not a good representation because a polymer is made of tens of thousands of atoms.

**Acknowledgments**

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**References**

Johnstone, A. H. (1991). Why is chemistry difficult to learn? Things are seldom what they seem. *Journal of Computer Assisted Learning,* 7**,** 75-83.