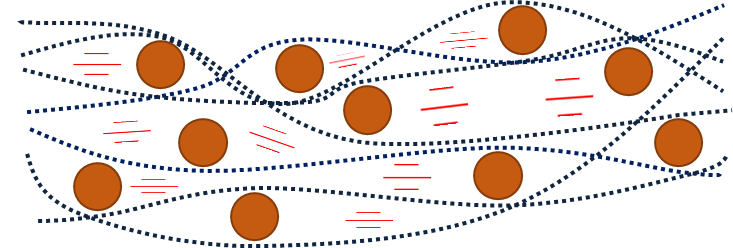
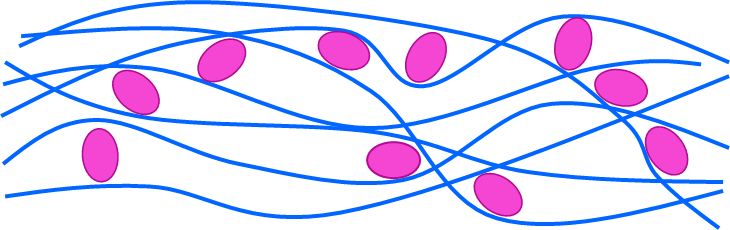
**Explaining plasticisers**

Two students draw diagrams to explain how plasticisers work.



Student A Student B

1. Look at the diagram drawn by student A.
   1. What do the blue lines represent?
   2. What do the pink ovals represent?
2. Look at the diagram drawn by student B.
   1. What do the dotted lines represent?
   2. What do the orange circles represent?
   3. What do the red lines represent?
3. Which diagram do you think helps to explain better why a plasticiser makes PVC polymer flexible? Explain you answer.

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

|  |
| --- |
| **Response activity** |
| **Explaining plasticisers** |

**Overview**

|  |  |
| --- | --- |
| Learning objective: | Materials scientists can design polymers with specific properties. |
| Observable learning outcome: | Explain how the addition of plasticisers between molecules can make a polymer softer and more flexible. |
| Activity type: | critiquing a representation |
| Key words: | polymer, plasticiser |

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

* PVC

**What does the research say?**

One research paper (Cooper et al., 2012) emphasises the importance of the idea that a substance’s molecular structure determines its macroscopic properties

Research (Cooper, Williams and Underwood, 2015) cites research that found that around a quarter of grade 12 (US) students taking part on the study indicated that intermolecular forces occurred within molecules. The authors found in their own student that when asked to draw the location of intermolecular forces some students drew just one molecule.

This question introduces students, at an early stage, to thinking about how a change in the structure of a polymer (by the addition of plasticisers) will affect its properties.

**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.

**Expected answers**

1 a The blue lines represent the polymer molecules.

B The pink lines represent the plasticiser.

2a

b

3 The diagram by student B is a better representation because it shows that there are forces between the molecules.

**Acknowledgments**

Developed by Helen Harden (UYSEG)

Images: Peter Fairhurst (UYSEG)

**References**

Cooper, M. M., et al. (2012). Development and assessment of molecular structure and properties learning progression. *Journal of Chemical Education,* 89(11)**,** 1351-1357.

Cooper, M. M., Williams, L. C. and Underwood, S. M. (2015). Student understanding of intermolecular forces: A multimodal study. *Journal of Chemical Education,* 92**,** 1288-1298.