

Properties of polymers – teacher notes

Education in Chemistry

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Use these notes along with the accompanying Powerpoint presentation for a lesson for 11–14 students on polymers and how they are formed

Lesson section	Notes	Resources
Starter/settler	What is the difference between an element, a compound and a mixture? Give as many examples of each as you can. Extension – what is an alloy?	Powerpoint presentation slides 2–5
Main activity 1	Introduce what a ceramic, polymer and composite is as well as examples of each.	The accompanying EIC article explains this and gives examples you might want to use.
Main activity 2	<p>Each student should create a molecule of ethene using a Molymod kit. This will be easier if each student receives a pre-made bag containing 2 carbon atoms, 2 double bonds, 4 single bonds and 4 hydrogen atoms. It is good practice to model how to make the ethene to the class and let the students create it at the same time as you.</p> <p><i>Note: If social distancing is still in effect, the students may need to do all the connecting of monomers together with the teacher supervising.</i></p> <p>Discuss some of the chemistry of ethene – no need to go into great detail, but enough so they can then make informed predictions about the properties – use slide 8 for prompts.</p> <p>Explain that as a class you are going to be demonstrating what happens during a polymerisation reaction. This is when many monomers react to form a polymer (reiterate that ‘mono’ means single, ‘poly’ means many, and ‘mer’ means unit).</p> <p>Using your ‘monomer’ as well as another, show how they cannot react by themselves. We must ‘break a bond’. (In industry, metallocene catalysis is used – at this key stage it is better to stay away from this, but it may be of interest to some students and could make for quick research task.) At this point, model breaking one of the carbon–carbon double bonds.</p>	<p>Powerpoint presentation from slide 6</p> <p>Molymod kits (2 carbon atoms, 2 double bonds, 4 single bonds and 4 hydrogen atoms per student)</p>

	<p>Ask your students to hold their monomer up again to check they are following. Using a student's monomer, show how the monomers react to form a 'dimer'. Ask for another volunteer's 'monomer' and ask 'what will we form now?' If they are struggling, state 'we started with a monomer (for one), formed a dimer (for two), what about with three?' Explain you have formed a 'trimer'.</p> <p>Explain that for a polymer to form, often millions of monomers react. Go around the room, demonstrating how the polymer is formed using as many monomers as possible. Ask students to hold the polymer up to show how long they are.</p> <p>Ask your students to compare this polymer to their monomers. 'How is it similar? How is it different?' The key point is that the polymer is much larger than the individual monomers.</p> <p>Go to slide 16 and ask: 'Which of these properties do you think this polymer will have?' The key point here is that the polymer will have a higher boiling and melting point and will be unreactive.</p> <p>At this point you can link the polymer to plastics and ask 'Is it useful for plastic bags to be unreactive? Why might it not be useful?' Here you can link the properties of plastics to problems with breaking down and degrading.</p>	
Consolidation	<p>Use the Quizlet to test your students' knowledge. Use this again over the coming weeks and months (spaced) to help embed the knowledge in their long-term memories.</p>	<p>https://quizlet.com/gb/516476118/ceramics-polymers-and-composites-flash-cards/?x=1jqY</p>