**ANSWERS: Polymerisation**

**2022**



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| **2021** | **Evidence** | **Achievement** | **Merit** | **Excellence** |
| **(i)****(ii)** | In an addition polymerisation reaction, C=C double bonds are broken inorder for new bonds to form between monomers as they link into longrepeating chains called polymers.Compound F is unsaturated, as it contains a reactive C=C double bond, and is therefore able to undergo this reaction type. Compound A is saturated, so only contains unreactive C–C single bonds, and therefore is unable to undergo this type of polymerisation. | • Correct polymer.• Identifies A is saturated /(C-C), or F is unsaturated /(C=C).• Partial explanation ofaddition polymerisation. | • Links saturated / (C-C), natureof A / unsaturated / (C=C)nature of F to reactivity.• Explains addition polymerisation. | • Fully explains differenceof A and F to undergo addition polymerisation with reference tostructure and reactivity with correctly drawn polymer. |

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| **2020** | **Evidence** | **Achievement** | **Merit** | **Excellence** |
|  | (1,1,2,2)-tetrafluoroethene | • Correctly draws the monomer.ORCorrectly names the monomer. | • Links correct structure tocurrent name. |  |
|  | Each monomer contains a reactive double bond between the two carbon atoms. The polymer has only single carbon-carbon bonds, which are not as reactive. Therefore, the polymer is less reactive, which is important when cooking using Teflon cookware, as it won’t react with any food or liquid or ability to withstand heat whilst cooking. | • Describes the structural difference between the monomer (C=C) / double bond / unsaturated and polymer(C–C) /single bond / saturated.ORRecognises that the formation of the polymer is an addition reaction.ORThe monomers join to form a chain• Monomer more reactive than polymer, so Teflon used to coat cooking utensils. | Links double bond to reactivity.ANDLinks single bond to nonreactivity. | • Justifies use of Teflon incooking by explainingreactivity differences betweenmonomer and polymer. |
| **2019** | **Evidence** | **Achievement** | **Merit** | **Excellence** |
|  | Polypropene | **Correct** |  |  |

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| **2018** | **Evidence** | **Achievement** | **Merit** | **Excellence** |
| **(i)****(ii)** | A close up of a clock  Description automatically generatedThe monomer forming perspex is not a geometric isomer. Ageometric isomer must have a double bond between two carbonatoms which prevents rotation. This monomer does have this, butthe other feature of a geometric isomer is that the carbon atoms ofthe double bond must have two different atoms or groups of atomsattached to them. One of the carbons on the monomer has a methyl group and a different group of atoms, but the other carbon has two hydrogen atoms. Therefore, it can’t have a cis and trans form. | **Correct structure**Identifies that the monomer isn’t a geometric isomer.ORStates a feature required forgeometric isomer. | Explains why the double bondcauses this isomeris*m*ORExplains why each C atom on the double bond must have two different atoms or groups of atoms attached. | Explains both features ANDrelates their answer specifically to the monomer |

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| **2017** | **Evidence** | **Achievement** | **Merit** | **Excellence** |
| **(a) (i)****(ii)****(iii)** | Each monomer contains a reactive double bond, the polymer has none in its structure.Therefore, the polymer is less chemically active than the monomer (or discusses physical property such as melting point).This means polymers are less reactive, so they can be used in many ways such as seat covers or clothing because they do not react with water.Addition reactions involve two (or more in the case of the polymers) molecules combining to make one molecule. An addition reaction occurs when double bonds are broken to form a single C–C bond, and two new single covalent bonds. In addition polymerisation, the monomers, chloroethene / vinyl chloride join in a long chain polymer, polyvinyl chloride, as the double bonds break and the C-atoms from each monomer are able to bond to C-atoms in other monomers. | Correctly draws the monomer.OREither identifies monomer or polymer reactivity / physical property.Describes an addition reactionORSuitable equation. | Explains why the reactivities / physical property of the monomer and polymer are different, and links this to at least one use.Explains what the term ‘additionpolymerisation’ means. | Explains the ‘additionpolymerisation’ term with a suitable equation. |

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| **2016** | **Evidence** | **Achievement** | **Merit** | **Excellence** |
| **(i)****(ii)** | ass91165aQ3b1_1Since the monomer for this reaction, styrene, is an alkene, when polymerisation occurs, the double bond in each styrene molecule is broken, freeing up a bonding space on each of the C atoms that was part of the double bond. This allows the monomers to join together by forming covalent bonds to make polystyrene. Since double bonds in styrene are being broken and molecules added into the freed up bonding spaces to make polystyrene, this is an addition reaction. Polymerisation reactions occur when many monomers are chemically joined. | Correct monomer is drawn.Correctly states why this is an addition reaction | Links how the polymer forms to why it is an addition reaction. |  |

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| **2015** | **Evidence** | **Achievement** | **Merit** | **Excellence** |
|  | ass91165Q2a1 | polymer correctly drawn (name isnot required) |  |  |

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| **2014** | **Evidence** | **Achievement** | **Merit** | **Excellence** |
| **(i)** |  | Draws TWO repeating units for thepolymer formed in Reaction 5. |  |  |
| (ii) | The molecular formulae of the two repeating units of both polymers are the same, but the structural formulae are different.ORStates repeating units are structural isomers.Addition polymerisation occurs when the C=C breaks and the carbon atoms in this double bond join to each other from adjacent molecules to form long chains. In Reaction 3, the polymer formed will have a carbon with one hydrogen and a methyl group, and a carbon with one hydrogen and an ethyl group, as its repeating unit, due to the double bond being on the C2 position.In Reaction 5, since the double bond is in a different position (the C1 position), the polymer formed will have as its repeating unit a carbon atom with 2 hydrogen atoms attached, and a carbon atom with one hydrogen attached and a propyl group attached. | * Recognises different positions of double bonds within the structures of Reactions 3 & 5.

 **OR**States that the monomers are structural isomers or something similar. | * Explains that the double bond located in different positions results in two different polymers
 | * Compares and contrasts the two polymers.
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| **2013** | **Evidence** | **Achievement** | **Merit** | **Excellence** |
| **ass91165Q2a** | correct polymercorrect monomer |  |  |

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| **2012** | **Evidence** | **Achievement** | **Merit** | **Excellence** |
|  |  | correct structure |  |  |

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