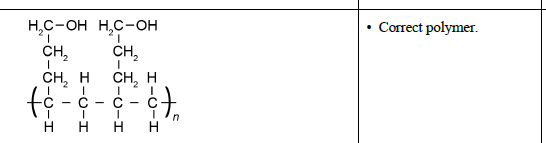
**ANSWERS: Polymerisation**

**2022**



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| **2021** | **Evidence** | **Achievement** | **Merit** | **Excellence** |
| **(i)**  **(ii)** | In an addition polymerisation reaction, C=C double bonds are broken in  order for new bonds to form between monomers as they link into long  repeating 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 of  addition polymerisation. | • Links saturated / (C-C), nature  of A / unsaturated / (C=C)  nature of F to reactivity.  • Explains addition polymerisation. | • Fully explains difference  of A and F to undergo addition polymerisation with reference to  structure and reactivity with correctly drawn polymer. |

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| **2020** | **Evidence** | | **Achievement** | | **Merit** | | **Excellence** |
|  | (1,1,2,2)-tetrafluoroethene | | • Correctly draws the monomer.  OR  Correctly names the monomer. | | • Links correct structure to  current 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.  OR  Recognises that the formation of the polymer is an addition reaction.  OR  The monomers join to form a chain  • Monomer more reactive than polymer, so Teflon used to coat cooking utensils. | | Links double bond to reactivity.  AND  Links single bond to nonreactivity. | | • Justifies use of Teflon in  cooking by explaining  reactivity differences between  monomer 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 generated  The monomer forming perspex is not a geometric isomer. A  geometric isomer must have a double bond between two carbon  atoms which prevents rotation. This monomer does have this, but  the other feature of a geometric isomer is that the carbon atoms of  the double bond must have two different atoms or groups of atoms  attached 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.  OR  States a feature required for  geometric isomer. | Explains why the double bond  causes this isomeris*m*  OR  Explains why each C atom on the double bond must have two different atoms or groups of atoms attached. | Explains both features  AND  relates 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.  OR  Either identifies monomer or polymer reactivity / physical property.  Describes an addition reaction  OR  Suitable 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 ‘addition  polymerisation’ means. | Explains the ‘addition  polymerisation’ term with a suitable equation. |

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| **2016** | **Evidence** | **Achievement** | **Merit** | **Excellence** |
| **(i)**  **(ii)** | ass91165aQ3b1_1  Since 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 is  not required) |  |  |

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| **2014** | **Evidence** | **Achievement** | **Merit** | **Excellence** |
| **(i)** |  | Draws TWO repeating units for the  polymer 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.  OR  States 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 polymer  correct monomer |  |  |

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

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