ANSWERS: **Isomers**

**2022**



**(ii)**



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| **2021** | **Evidence** | **Achievement** | **Merit** | **Excellence** |  |
| (a)(i)(ii)(b) (i)(ii)2 | 2 and 3They have the same molecular formula, C6 H12, but have a different order of connectivity of atoms / different arrangement of atoms,Compound 2 is cyclic / ring and Compound 3 is a straight chainTo form *cis* and *trans* isomers, a carbon-carbon double bond is required, and the atoms / groups on each of the C atoms of the double bond must be different. Compound 3 has a carbon-carbon double bond. This bond is rigid, so does not allow rotation to occur around it. Both structures also have two different atoms / groups on each of the C atoms of the double bond; an H atom and a CH2CH3 group.Propan-1-ol: PrimaryMethylpropan-2-ol: Tertiary3-chloropentane: SecondaryEthanol: PrimaryIn Propan-1-ol, the hydroxyl group is bonded to a carbon atom that is directly bonded to 1 other carbon atom, making it a primary alcohol. In the case of methylpropan-2-ol, the carbon bearing the hydroxyl group is directly bonded to 3 other carbon atoms, making it a tertiary alcohol. | • Correct compounds identified.• Correct explanation.• Correctly identifies *cis* and*trans* isomers.• States the need for a carbon carbon double bond AND two different atoms / groups oneach C atom of the doublebond.• THREE correct.• Classification due to number of carbons bonded to carbonbearing hydroxyl group. | • Links features of the structureof the compound.* Explains why the carbon carbon double bond

AND two different atoms / groups on each C atom of the double bond are required.Correctly compares the twoclassifications. | Fully justifies how thestructural features ofCompound 3 allow forgeometric isomerism. |  |

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| **2020** | **Evidence** | **Achievement** | **Merit** | **Excellence** |
| (i)(ii)(iii) | Constitutional / structural.Geometric.Constitutional isomers have the same molecular formula, but a different arrangement of their atoms. All three molecules have a formula of C4H8 / but **A** has a double bond on the first carbon,whereas **B** and **C** have their double bond on the second carbon / **A** is named but-1-ene, whereas **B / C** are named but-2-ene.To form geometric isomers, a carbon-carbon double bond is required, and the atoms / groups and on each of the C atoms of the double bond must be different. Both **B** and **C** have a methyl CH3 (group) and H (atom) attached on each of the C atoms of the double bond.The carbon-carbon double bond is rigid / fixed, so does not allow rotation to occur around it. Molecules have a different spatial arrangement.When both the CH3 groups / H atoms are on the same side of the double bond, it is the *cis* isomer. This is molecule **B**. When both the CH3 groups / H atoms are on different sides of the double bond, it is the *trans* isomer. This is molecule **C**. Molecule **A** is not a geometric isomer because the atoms on the first carbon of the double bond are the same. | • Circles TWO correct answers.• Defines constitutional(structural isomers).• Describes a feature ofgeometric isomerism. | • Links a feature ofconstitutional isomerism tomolecules **A and B**,• Links a feature of geometric isomerism to molecule **B** and **C**. | Fully explained all features ofconstitutional isomerism withregards to molecules **A and B**,• Fully explained features ofgeometric isomerism withregards to molecule **B** and **C**. |

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| **2019** | **Evidence** | **Achievement** | **Merit** | **Excellence** |
| (a)(b) (i)(ii) | Compound **A** is a geometric isomer because it has the two required features. It has a double bond which prevents rotation. Compound **B** doesn’t have this. Compound **A** also has different atoms / groups of atoms on each carbon on the double bond. Both carbons have a methyl group and a hydrogen atom that can be arranged differently in space. | • TWO isomers drawn and classified.• Draws and names the two isomers.• Describes the features required for geometric isomers.OR• Has double bond which restricts rotation. | • Explains the features required for geometric isomers. | • Relates the requirements of cis-trans isomers relevant to the named and drawn examples ofbut-2-ene. |

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| **2018** | **Evidence** | **Achievement** | **Merit** | **Excellence** |
| 1.2. | 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.PrimaryA picture containing object  Description automatically generated

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| SecondaryA close up of a logo  Description automatically generated | TertiaryA screenshot of a cell phone  Description automatically generated |

 | Identifies that the monomerisn’t a geometric isomer.ORStates a feature required forgeometric isomer.TWO correct isomers | Identifies that the monomer isn’t a geometric isomer.ORStates a feature required for geometric isomer. | Explains both features ANDrelates their answerspecifically to the monomer |

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| **2017** | **Evidence** | **Achievement** | **Merit** | **Excellence** |
| (i)(ii) | Depends on candidate answers, but 3 and 4 using the answers above.To form *cis* and *trans* isomers, a carbon-carbon double bond is required, and the atoms / groups on each of the C atoms of the double bond must be different.Structure 3 and 4 above, both have a carbon-carbon double bond. This bond is rigid, so does not allow rotation to occur around it. Both structure 3 and 4 also have two different atoms / groups on each of the C atoms of the double bond, an H atom and a CH3 group.In structure 3, both the CH3 groups / H atoms are on the same side of the double bond, so it is the *cis* isomer, whereas in structure 4 both the CH3 groups / H atoms are on different sides of the double bond, resulting in a *trans* isomer. | Correctly draws THREE isomers.• Correctly identifies *cis* and *trans* isomers.• States the need for a carbon-carbon double bond AND two different atoms / groups on each C atom of the double bond. | Explains why the carbon-carbon double bond AND two different atoms / groups on each C atom of the double bond are required. | Justifies the choice ofstructures as *cis* and *trans* in terms of the carbon-carbon double bond and the position of the different groups on the carbon atoms of the double bond. |

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| **2016** |  |  |  |  |
| (a)(b) (i)(ii) (c) (i)(ii) | ass91165aQ1a2_1**A**. Tertiary (or 3o)**B**. Primary (or 1o)**C**. Secondary (or 2o)Classifying haloalkanes as primary, secondary, or tertiary requires counting the number of C or H atoms bonded to the C atom to which the halogen is attached. If the C atom bonded to the halogen has 3 other carbon atoms (or 0 H atoms) bonded to it, the haloalkane is a tertiary (3o) alkane.**A**. *trans***B**. *cis*1,2-dibromoethene can form *cis* and *trans* isomers because it has a double bond. The double bond between two carbon atoms does not allow any rotation of atoms around it.As well as the double bond, the C atoms directly attached to it must have two different atoms or groups attached to them. For 1,2-dibromoethene, both the C atoms on the double bond have an H and a Br atom bonded to them.When these two requirements are met, two alkenes can have the same molecular formula and the same sequence of atoms in the formula, but a different arrangement in space (a different 3D formula), hence they are *cis* and *trans* isomers. | * All THREE classifications correct.
* States how to classify haloalkanes correctly.
* Correctly identifies both *cis* and *trans* isomers,

AND EITHERStates that a rigid double bond is needed.OREach carbon around the double bond needs TWO different atoms or groups attached to it. | Links how to classify haloalkanes correctly to structure A in the table.* Explains why the double bond is required for *cis* and *trans* isomerism.

ORExplains why each C atom on the double bond must have two different atoms or groups attached to them. | * Explains why the double bond and two different atoms or groups of atoms on the C atoms of the double bond are required for *cis* and *trans* isomers.

ANDRelates their answer specifically to the example given in the question. |

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