

13. An introduction to AS Level organic chemistry

13.4 Isomerism- structural isomerism and stereoisomerism

Paper 2

Marking Scheme



Q1.

(a)	Three-dimensional stereoisomers of $\text{CH}_3(\text{CH}_2)_5\text{CHBrCH}_3$	2
	M1 correct representation of left-hand answer as 3d structure of one of the enantiomers of $\text{CH}_3(\text{CH}_2)_5\text{CHBrCH}_3$ M2 correct representation of 3d structure of the second enantiomer of $\text{CH}_3(\text{CH}_2)_5\text{CHBrCH}_3$	

Q2.

(a)(i)	(molecules with the) same structural formula (and same molecular formula) with different arrangement of atoms / groups in space	1
(a)(ii)	M1 number of stereoisomers = 8 M2 reasoning: 2 chiral centres AND 1 C=C (producing a cis-and trans or geometrical pair)	2
(a)(iii)	$\text{C}_{13}\text{H}_{20}\text{O}_3$	1
(a)(iv)	ester AND carbonyl / ketone AND C=C (bond) / alkene	1

Q3.

(d)(i)	M1 $\frac{79.5}{209.4} : \frac{20.5}{18.0} = 0.380 : 1.14 = 1:3$ OR $18x / (102.9 + 3(35.5) + 18x) = 0.205$ $x = 3$ OR $(102.9 + 3(35.5)) / (209.4 + 18x) = 0.795$ $x = 3$ M2 $x = 3$	1
(d)(ii)	molecules with the same structural formula and same molecular formula with different 3D / different spatial arrangement of atoms / groups	1
(d)(iii)	a single product is made	1
(d)(iv)		1
		1

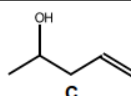
Q4.

(d)(i)	structural / positional	1
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
Q5.

(a)	molecules / isomers with the same molecular formula / same number of atoms of each element AND different structural formulae / different structures	1
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Q6.

(c)(i)	 <p>M1 CH₃CH(OH) present M2 five carbons in a straight chain AND molecular formula C₅H₁₀O AND 1 C=C structure which shows only one type of stereoisomerism</p>	2
(c)(ii)	optical	1

Q7.

(a)(i)	3-methylbut-1-ene	1
(a)(ii)	one end / one C of the C=C bond has the same groups attached	1
(a)(iii)		1

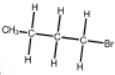



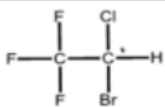
Q8.

(a)(i)	(it has molecules that) contain a chiral carbon / centre OR are non-superimposable mirror images	1
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Q9.

(a)	M1 optical M2 one of the C atoms has 4 different groups / atoms attached	2
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Q10.

(a)(i)	$\text{CH}_3(\text{CH}_2)_2\text{CH}_2\text{Br}$  OR  name: 1-bromobutane	$\text{CH}_3\text{CH}_2\text{CH}(\text{Br})\text{CH}_3$  OR  name: 2-bromobutane	2
M1 structure of isomer 1 AND name M2 structure of isomer 2 AND name (in any order)			
(a)(ii)	positional		1
(b)(i)			1

Q11.

(d)(iv)	(molecules / isomers with) the same molecular formula	1
	but different structural formulae	1

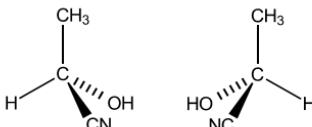
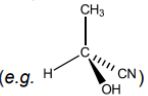
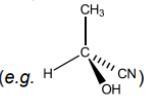
Q12.

(b)		1
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Q13.

(b)	M1 both have molecular formula - $\text{C}_6\text{H}_{12}\text{O}_6$ M2 idea that in glucose and fructose there are the same number and type of atoms present but the atoms are arranged in a different order ie one has a carbonyl group at the end of the chain/molecule and the other has a carbonyl group in the middle of the chain/molecule	2
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Q14.

(b)(i)	optical	1
(b)(ii)	 <p>M1 one 3-D structure of correct molecule shown.</p> <p>M2 a mirror image of the molecule drawn in M1 OR same profile with two groups swapped</p>  <p>(e.g. )</p>	1
	M3 central chiral C shown as *	1
(c)	$\text{CH}_3\text{CH}(\text{OH})\text{CO}_2\text{H}$ OR $\text{HO}_2\text{CCH}(\text{OH})\text{CH}_3$	1

Q15.

(a)(i)	C_4H_{10} / same molecular formula / OR same number of carbon (atoms) and hydrogen (atoms)	1
	different structural formula OR description of different structural formula which does not imply stereoisomerism	1
(a)(ii)	structural / chain	1