InkChemistry

QUESTION WORKBOOK

Optical isomerism

Carbonyls and carboxylic acids · Unit C20

AQA 3.3.7 · OCR A 6.2.2

17 questions · 55 marks

NAVY SCREEN EDITION

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SECTION A · Short, 1 to 2 marks

A1 OP-Q3

Identify the chiral centre in 2-methylbutan-1-ol, $CH_3CH_2CH(CH_3)CH_2OH$, and give the four groups attached to it. [2]

A2 OP-Q7

Explain why 3-methylpentane, $CH_3CH_2CH(CH_3)CH_2CH_3$, does not show optical isomerism. [2]

SECTION B · Standard, 3 to 5 marks

B1 OP-Q6

Explain why the 2-hydroxypropanenitrile formed from ethanal with KCN followed by dilute acid is optically inactive, although its molecules are chiral. [4]

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B2 OP-Q10 Name the organic product when butanone is reduced by $NaBH_4$, and when pentan-3-one reacts with KCN followed by dilute acid, and explain whether a sample of each product rotates plane-polarised light. [4]

B3 OP-Q17 Evaluate the claim that the harm caused by thalidomide would have been avoided if only the sedative enantiomer had been sold. [4]

B4 OP-Q2 State what is meant by the terms chiral centre and enantiomers, and state how a pair of enantiomers differ in their effect on plane-polarised light. [3]

B5 OP-Q4 Identify the number of chiral centres in isoleucine, $CH_3CH_2CH(CH_3)CH(NH_2)COOH$, and the four groups on each. [3]

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B6 OP-Q8 Draw the two enantiomers of 2-bromobutane in a way that shows they are optical isomers, and mark the chiral centre. [3]

B7 OP-Q9 Describe how a polarimeter is used to show whether a sample of lactic acid is a single enantiomer or a racemic mixture. [3]

B8 OP-Q11 Compare the physical and chemical properties of the two enantiomers of 2-hydroxypropanoic acid. [3]

B9 OP-Q12 Calculate the angle of rotation given by a mixture containing 75% of the (+) enantiomer and 25% of the (-) enantiomer of a compound, if the pure (+) enantiomer rotates the plane by +12.0° under the same conditions. [3]

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B10 OP-Q13 Calculate the percentage of each enantiomer in a sample of a compound that rotates the plane of polarised light by -6.0°, if the pure (-) enantiomer rotates it by -15.0° under the same conditions. [3]

B11 OP-Q14 Suggest three reasons why a pharmaceutical company might choose to sell a drug as a single enantiomer rather than as a racemate. [3]

B12 OP-Q18 Explain why the hydrolysis of a single enantiomer of 2-bromopentane by an SN2 mechanism gives a product that rotates plane-polarised light. [3]

B13 OP-Q19 Suggest why warming a single enantiomer of 3-bromo-3-methylhexane with aqueous sodium hydroxide gives a product that does not rotate plane-polarised light. [3]

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B14 OP-Q20 Calculate the percentage of the product formed by the SN1 route when a single enantiomer of 2-bromobutane is hydrolysed and the product rotates the plane by +4.0°, if pure (+)-butan-2-ol rotates it by +16.0° under the same conditions and the SN2 route gives only the (+) enantiomer. [3]

SECTION C · Long, 6 marks or more

C1 OP-Q21 Explain, using 2-hydroxypropanoic acid (lactic acid) as the example, what optical isomerism is, how the two isomers are told apart, and why lactic acid made in muscle rotates plane-polarised light while lactic acid made in the laboratory from ethanal does not. [6]

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