

Exercise walk-through

4.5.1

Chirality, optical evidence and substitution

Pearson Edexcel · International A-Level · Chemistry

Find the temperature boundary

Your turn

$\Delta H = +36.0 \text{ kJ mol}^{-1}$; $\Delta S(\text{system}) = +120 \text{ J mol}^{-1} \text{ K}^{-1}$. Which condition gives positive total entropy?

- A. T below 300 K
- B. T above 300 K
- C. Every temperature
- D. No temperature

Buffer after neutralisation

Your turn

0.0100 mol HA receives 0.00400 mol OH^- . Which HA:A⁻ ratio enters the buffer expression?

- A. 10:4
- B. 6:4
- C. 4:6
- D. 10:6

Independent structural identification

Your turn

$\text{C}_3\text{H}_6\text{O}$ has two carbon-13 signals, gives iodoform and no Tollens' silver. Which structure fits?

- A. Propanal
- B. Propanone
- C. Propan-1-ol
- D. Ethanoic acid

Exercises 2.1·2.3

2.1 Name the four groups at the chiral centre of 2-bromobutane. [2]

2.2 Explain why propan-2-ol is achiral and butan-2-ol is chiral. [2]

2.3 One pure enantiomer gives $+12^\circ$ under specified conditions. State the rotation of its pure partner and an equal mixture under identical conditions. [2]

3 Exam-style questions

Exercises 2.1·2.3

2.1 Name the four groups at the chiral centre of 2-bromobutane. [2]

2.1 Br, H, CH₃ and CH₂CH₃.

2.2 Explain why propan-2-ol is achiral and butan-2-ol is chiral. [2]

2.2 Propan-2-ol has two identical CH₃ groups at its central carbon; butan-2-ol has four different groups at carbon 2.

2.3 One pure enantiomer gives +12° under specified conditions. State the rotation of its pure partner and an equal mixture under identical conditions. [2]

3 Exam-style questions

2.3 −12°; 0°.

Exercises 3.1·3.2

3.1 An optically active secondary halogenoalkane undergoes substitution. Product is optically active with inversion. Explain which simple mechanism this supports, and why the sign of rotation alone is not a structural proof. [3]

3.2 A product solution has zero optical rotation. Give two different molecular explanations and an additional observation that would help distinguish them. [3]

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3.1 Supports S_N2, with concerted backside attack and inversion. Rotation sign cannot be inferred solely from a wedge/dash configuration and requires measurement/other structural evidence.

3.2 A product solution has zero optical rotation. Give two different molecular explanations and an additional observation that would help distinguish them. [3]

3.2 An achiral product, or equal amounts of two enantiomers. Establish structure and whether four different groups occur at a tetrahedral carbon; suitable enantiomer-resolving evidence can distinguish an enantiomer mixture.

Exercise 3.3

3.3 Draw two opposite configurations of 2-bromobutane with wedge/dash bonds and label the four groups. [4]

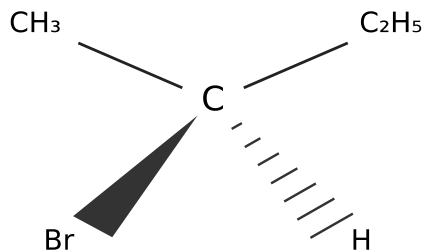
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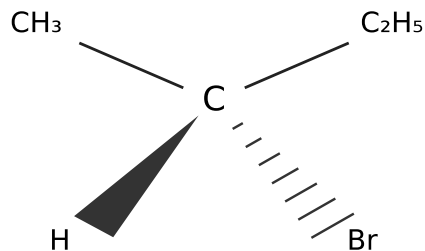
3.3

Swap two groups to obtain the other enantiomer

One enantiomer of 2-bromobutane



Opposite configuration



B1 for each correctly connected four-group centre; B1 for a complete wedge/dash representation; B1 for opposite configurations.