

AQA A-Level Chemistry

Optical isomerism

Questions only

All 8 optical isomerism questions

Questions

8

Total marks

33

Time allowed

43 min

Name

Class or teacher

Date

Instructions

- Answer all questions in the spaces provided.
- Use black ink. Show your working for every calculation.
- You may use a scientific calculator and the AQA Data Sheet.
- Print the separate mark scheme when you are ready to mark your answers.

For marking

Q	Source	Marks	Score
1	2020 A-level P2 Q2	7	
2	2021 A-level P2 Q6	7	
3	2020 A-level P3 Q26	1	
4	2017 A-level P2 Q4	8	
5	2017 A-level P3 Q13	1	
6	Specimen A-level P2 Q11	7	
7	Specimen A-level P3 Q30	1	
8	2017 A-level P3 Q24	1	

Total _____ / 33 Percentage _____ %

Questions from AQA past papers, 2017–2021, reproduced for revision. Practise these topics online, with instant marking:

whiteboardchemistry.com/revision/aqa-a-level-chemistry/exam-questions?topics=optical-isomerism&len=0

Questions

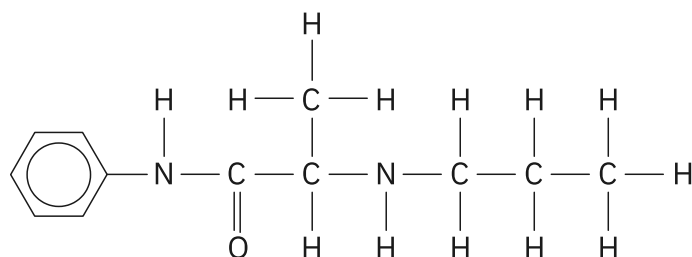
Optical isomerism · 8 questions · 33 marks · time allowed 43 min

Q1 · November 2020 · Paper 2 · Q2 · [7 marks]

Prilocaine is used as an anaesthetic in dentistry.

Figure 1 shows the structure of prilocaine.

Figure 1



(a) Draw a circle around any chiral centre(s) in Figure 1.

[1 mark]

Draw your answer on the figure above.

(b) Identify the functional group(s) in the prilocaine molecule.

Tick (✓) the box(es) corresponding to the functional group(s).

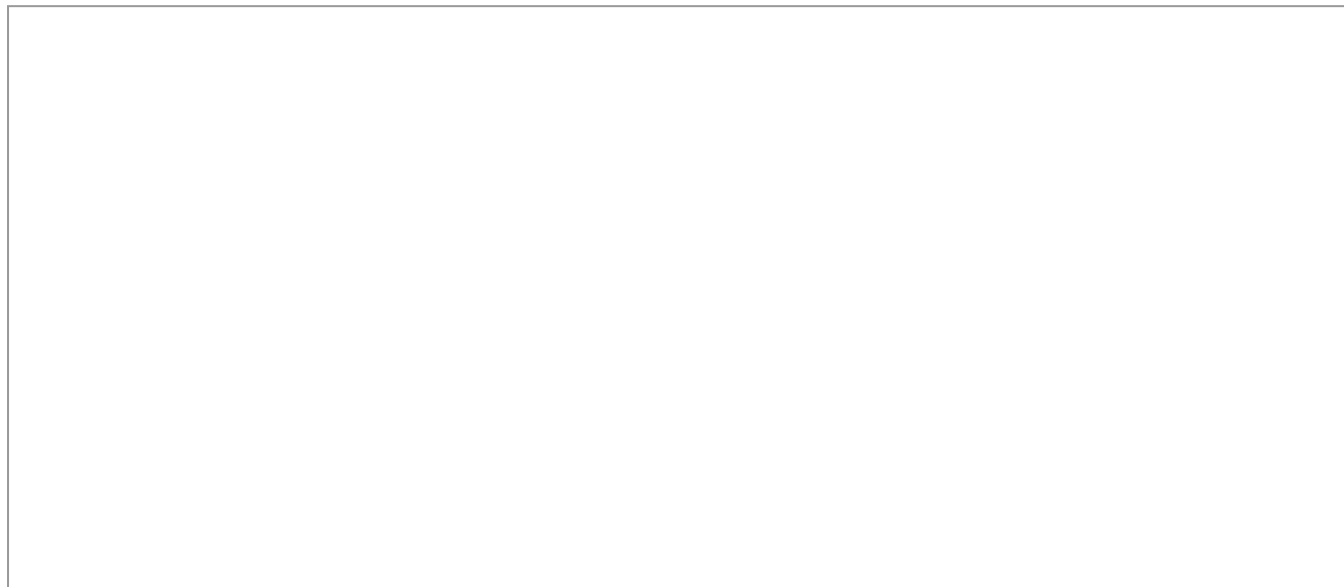
Amide	Amine	Ester	Ketone
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[1 mark]

(c) Prilocaine is completely hydrolysed in the human body to give a mixture of products.

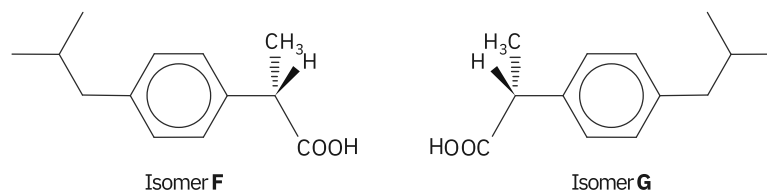
Draw the structures of the two organic products formed in the complete hydrolysis of prilocaine in acidic conditions.

[3 marks]



(d) Figure 2 shows optical isomers F and G.

Figure 2



Isomer F is the active compound in the medicine ibuprofen.

In the manufacture of ibuprofen both isomers F and G are formed. An enzyme is then used to bind to isomer G and catalyse its hydrolysis.

After the products of hydrolysis of G are removed, a pure sample of isomer F is collected.

Explain how a structural feature of this enzyme enables it to catalyse the hydrolysis of isomer G but not the hydrolysis of isomer F.

[2 marks]

Q2 • November 2021 • Paper 2 • Q6 • [7 marks]

This question also needs NMR.

This question is about isomers with the molecular formula $C_5H_{10}O$

(a) Draw the skeletal formula of a branched chain aldehyde with molecular formula $C_5H_{10}O$ that is optically active.

[1 mark]

(b) Describe how you distinguish between separate samples of the two enantiomers of the branched chain aldehyde $C_5H_{10}O$

[2 marks]

(c) Draw the E and Z forms of a structural isomer of $C_5H_{10}O$ that shows both optical and geometric isomerism.

E isomer

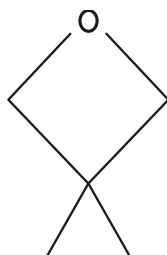
Z isomer

[2 marks]

(d) Isomer J is cyclic and has an ether functional group (C–O–C)

Isomer J has only three peaks in its ^{13}C NMR spectrum.

Isomer J



Draw two other cyclic isomers of $\text{C}_5\text{H}_{10}\text{O}$ that have an ether functional group and only three peaks in their ^{13}C NMR spectra.

[2 marks]

Q3 • November 2020 • Paper 3 • Q26 • [1 mark]

Which does not contain an asymmetric carbon atom?

Tick (✓) one box.

- ☐ **A** $\text{CH}_3\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_3$
- ☐ **B** $\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_2\text{CH}_3$
- ☐ **C** $\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{OH}$
- ☐ **D** $\text{CH}_3\text{CH}_2\text{CHClCH}_3$

Q4 • June 2017 • Paper 2 • Q4 • [8 marks]

This question also needs Aldehydes and ketones.

The aldehyde $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CHO}$ reacts with KCN followed by dilute acid to form a racemic

mixture of the two stereoisomers of $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}(\text{OH})\text{CN}$

04.1 Give the IUPAC name of $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}(\text{OH})\text{CN}$

[1 mark]

04.2 Describe how you would distinguish between separate samples of the two stereoisomers of $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}(\text{OH})\text{CN}$

[2 marks]

04.3 Explain why the reaction produces a racemic mixture.

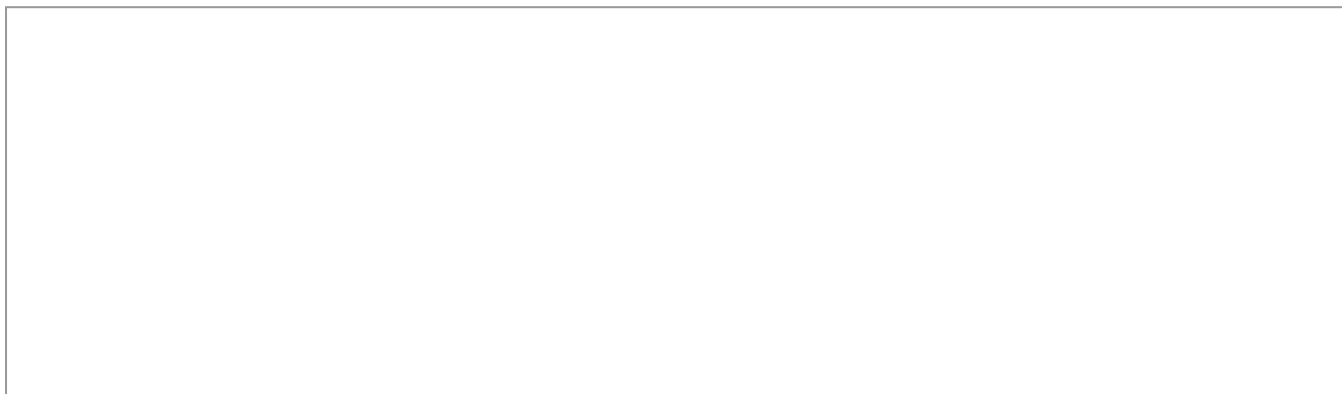
[3 marks]

04.4 An isomer of $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CHO}$ reacts with KCN followed by dilute acid to form a compound that does not show stereoisomerism.

Draw the structure of the compound formed and justify why it does not show stereoisomerism.

[2 marks]

Structure

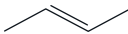
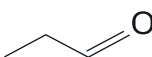
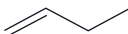


Justification

Q5 • June 2017 • Paper 3 • Q13 • [1 mark]

This question also needs Aldehydes and ketones and Alkenes.

Which pair of compounds does not form a racemic mixture when the compounds react?

A	 + HCl
B	 + HCN
C	 + HCl
D	 + HCN

Tick (✓) one box.

☐ **A** A

☐ **B** B

☐ **C** C

☐ **D** D

Q6 • AQA specimen paper • Paper 2 • Q11 • [7 marks]

This question also needs Aldehydes and ketones.

Butanone is reduced in a two-step reaction using NaBH_4 followed by dilute hydrochloric acid.

(a) Write an overall equation for the reduction of butanone using [H] to represent the reductant.

[1 mark]

(b) By considering the mechanism of the reaction, explain why the product has no effect on plane polarised light.

[6 marks]

Q7 • AQA specimen paper • Paper 3 • Q30 • [1 mark]

This question also needs Aldehydes and ketones.

Which compound forms optically active compounds on reduction?

Tick (✓) one box.

- ☐ A $\text{CH}_3\text{CH}_2\text{C}(\text{CH}_3)=\text{CHCH}_3$
- ☐ B $\text{CH}_3\text{CH}_2\text{C}(\text{CH}_3)=\text{CH}_2$
- ☐ C CH_3COCH_3
- ☐ D $\text{CH}_3\text{CH}_2\text{COCH}_3$

Q8 • June 2017 • Paper 3 • Q24 • [1 mark]

Which compound does not show stereoisomerism?

Tick (✓) one box.

- ☐ A 1,2-dichloropropene
- ☐ B 1,2-dichloropropane
- ☐ C 1,3-dichloropropene
- ☐ D 1,3-dichloropropane

Source: AQA A-Level Chemistry past papers. Reproduced for revision at whiteboardchemistry.com.

Mark scheme:

whiteboardchemistry.com/revision/aqa-a-level-chemistry/exam-questions/pdf/optical-isomerism-mark-scheme.pdf