AQA A-Level Chemistry

Optical isomerism mark scheme · goes with “Optical isomerism” · whiteboardchemistry.com/revision/aqa-a-level-chemistry/exam-questions

Mark schemes

Optical isomerism · 9 questions

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

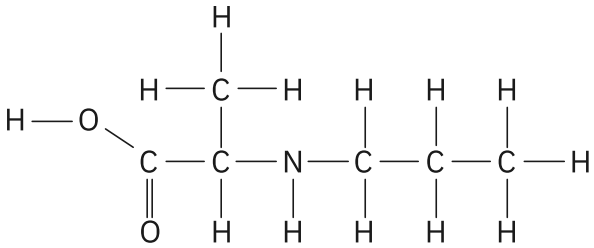
(a) One circled C atom only – The C attached to CH_3/C=O/ H and NH

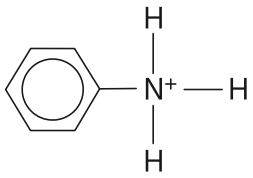
[1 mark]

(b) Two ticks only for amine and amide

[1 mark]

(c)

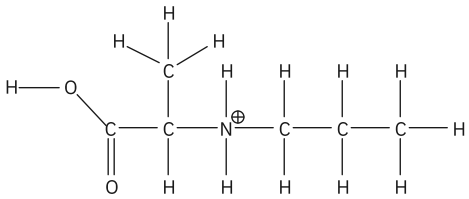




M1 for choosing the correct bond to hydrolyse

M2 and M3 for the correct structures of the products

Allow protonated amino acid for M2



Allow $C_6H_5NH_3^+$ or + outside a square bracket

[3 marks]

(d) M1 Enzyme has an <u>active site</u>

[1 mark]

The G-Enantiomer / Enzyme has the correct stereo chemistry / stereospecific

Or

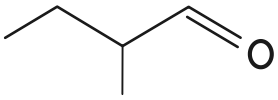
The G-Enantiomer / Enzyme has the complementary shape

For M2 allow opposite argument for F-Enantiomer

[1 mark]

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

(a)



[1 mark]

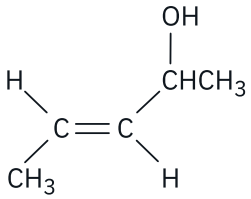
(b) Use Plane polarised light

<u>rotates</u> (the plane of) in opposite directions

[2 marks]

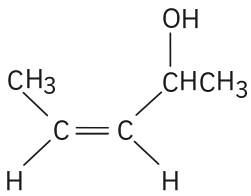
(c)

M1



Must be E isomer

M2



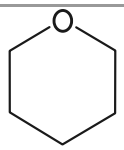
Must be Z isomer

Allow 1 mark out of 2 for 2 correct structures but shown in the wrong boxes

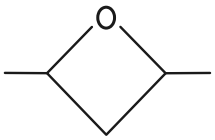
[2 marks]

(d)

M1



M2



[2 marks]

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

Answer: **A**

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

04.1

2-hydroxyhexanenitrile

[1 mark]

04.2

(Plane) polarised light

Enantiomers would rotate light in opposite directions

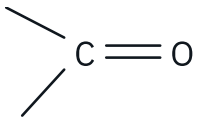
not different alone

[2 marks]

04.3

planar carbonyl group or

planar



Attack from either side

With equal probability

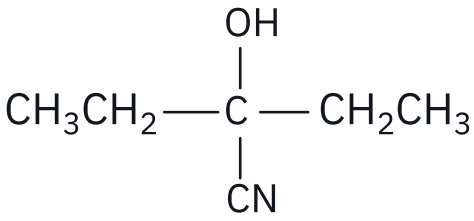
OR produces equal amounts (of the two isomers/enantiomers)

Not planar molecule,

not planar bond, not planar C=O

[3 marks]

04.4



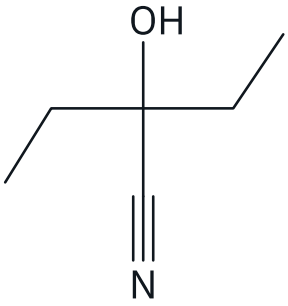
Does not contain a chiral centre

OR does not contain C attached to 4 different groups

OR contains two identical/ethyl groups

OR symmetrical (product)

Allow C_2H_5 or skeletal



M2 dependent on correct M1 (No structure = 0)

If pentan-3-one drawn then allow symmetrical ketone for M2

[2 marks]

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

Answer: **D**

Q6 · June 2019 · Paper 3 · Q4 · [9 marks]

04.1

nucleophilic addition

both words needed

NOT any additional names

[1 mark]

04.2

M1 racemic (mixture) / racemate

M2 planar (around) carbonyl / C=O

M3 (equal chance of) attack from each side (by CN^-)

M4 a correct structure of 2-hydroxypropanenitrile

M5 correct 3D representations of both isomers, e.g.

M2 NOT molecule is planar

ALLOW flat for planar

M4 any correct 2D or 3D structure

M5 must show at least one wedge bond and one dash bond in each structure and any bonds in the plane cannot be at 180° to each other

*second structure could be drawn as mirror image of first **or** with same orientation with two groups swapped round, e.g.*

ALLOW ECF for second structure from incorrect first structure, providing molecule is chiral

[5 marks]

04.3

M1 conc H_2SO_4 or conc H_3PO_4

M2 heat / 170°C

M1 ALLOW conc to come from conditions line

M2 depends on attempt at correct reagent in M1

ALLOW high temperature / hot / 100-300°C / 373 – 573 K / reflux

IGNORE references to pressure

IGNORE warm

NOT ethanolic / alcoholic

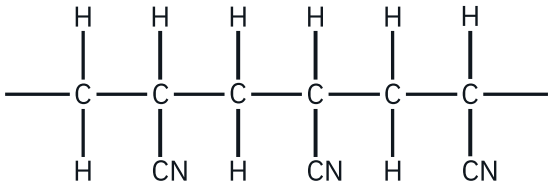
Alternative answer

M1 Al_2O_3

M2 pass vapour over hot Al_2O_3

[2 marks]

04.4



MUST show trailing bonds

IGNORE any brackets or n

NOT C–N or C=N if CN group displayed

ALLOW structures with CN on either C in each of the three units

ALLOW –CH_2–CH(CN)–CH_2–CH(CN)–CH_2–CH(CN)–

[1 mark]

Q7 · AQA specimen paper · Paper 2 · Q11 · [7 marks]

(a) $CH_3CH_2COCH_3 + 2[H] \rightarrow CH_3CH_2CH(OH)CH_3$

[1 mark]

(b)

This question is marked using levels of response.

Level 3

5 – 6 marks

All stages are covered and the explanation of each stage is generally correct and virtually complete.

Answer is communicated coherently and shows a logical progression from stage 1 to stage 2 then stage 3.

Level 2

3 – 4 marks

All stages are covered but the explanation of each stage may be incomplete or may contain inaccuracies OR two stages are covered and the explanations are generally correct and virtually complete.

Answer is mainly coherent and shows progression from stage 1 to stage 3.

Level 1

1 – 2 marks

Two stages are covered but the explanation of each stage may be incomplete or may contain inaccuracies, OR only one stage is covered but the explanation is generally correct and virtually complete.

Answer includes isolated statements but these are not presented in a logical order or show confused reasoning.

Level 0

0 marks

Insufficient correct chemistry to gain a mark.

Indicative Chemistry content

Stage 1: Formation of product

- Nucleophilic attack
- Planar carbonyl group
- H^- attacks from either side (stated or drawn)

Stage 2: Nature of product

- Product of step 1 shown
- This exists in two chiral forms (stated or drawn)
- Equal amounts of each enantiomer / racemic mixture formed

Stage 3: Optical activity

- Optical isomers / enantiomers rotate the plane of polarised light equally in opposite directions
- With a racemic / equal mixture the effects cancel

[6 marks]

Q8 · AQA specimen paper · Paper 3 · Q30 · [1 mark]

Answer: **D**

Q9 · June 2017 · Paper 3 · Q24 · [1 mark]

Answer: **D**

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