AQA A-Level Chemistry

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

Mark schemes

Organic synthesis · 7 questions

Q1 · November 2021 · Paper 2 · Q8 · [13 marks]

(a) Dehydration

Allow (acid catalysed) Elimination

Conc H_2SO_4

Allow Conc H_3PO_4

[2 marks]

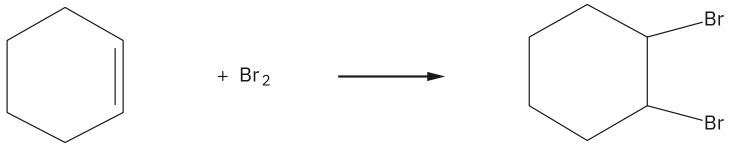
(b) Br_2

Allow bromine (water)

Allow Cl_2 or I_2

Allow O_2 if epoxide route used

M2



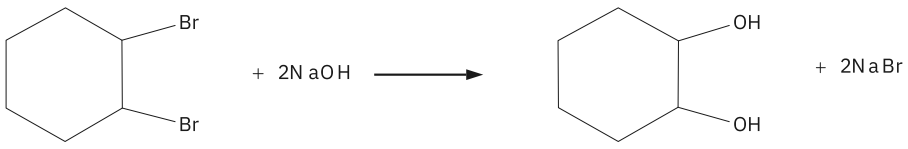
allow conseq equation to H_2, H_2O, HBr, HCl. HI and H_2SO_4

An epoxide is a feasible alternative that could score here and consequentially M3 and M4

NaOH

Or KOH or other suitable strong alkali

M4

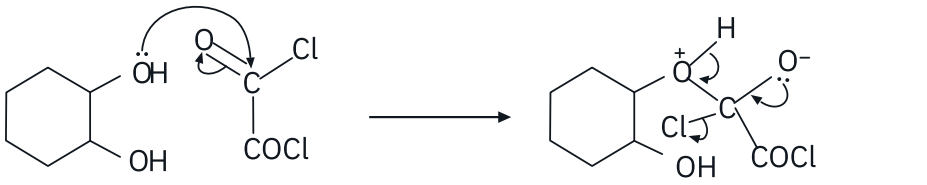


Allow this equation with molecular formulae

[4 marks]

(c) M1 (nucleophilic)addition-elimination

Note lone pair required for M5



M2 curly arrow from lp on O to C
M3 curly arrow from double bond to O
M4 for structure of intermediate
M5 for 3 curly arrows

[5 marks]

(d) Less energy used OR Better yield

OR reduces practical losses, simpler plant,

Less waste OR Less pollution

OR maximises the use of raw materials in the process into useful products, saves resources

[2 marks]

Q2 · June 2024 · Paper 2 · Q8 · [12 marks]

(a) M1 Electrophilic Addition

M2 HBr

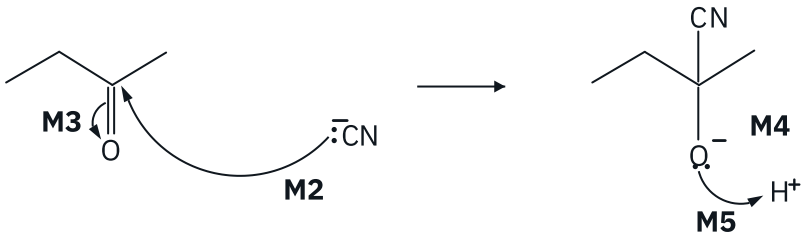
[2 marks]

(b) M1 Butan-2-ol or correct structure eg $CH_3CH(OH)CH_2CH_3$

M2 NaOH AND (warm) aqueous (Allow cold if stated)

[2 marks]

(c) M1 HCN or KCN/H_2SO_4



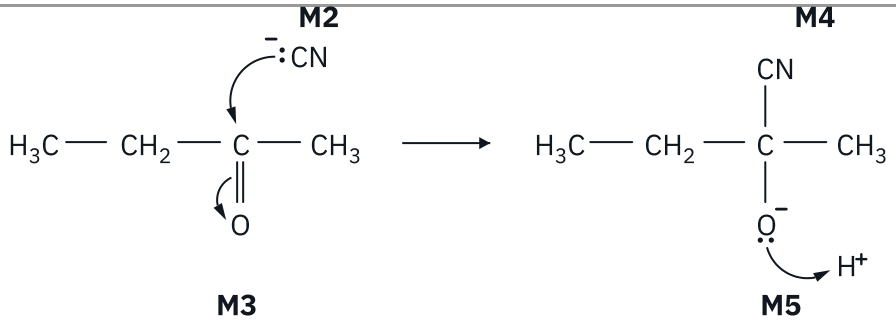
M2 Arrow from lone pair on C to C of C=O

M3 Arrow from C=O to O

M4 Structure of intermediate including negative on O

M5 Arrow from lone pair on O to H^+

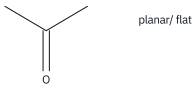
OR



[5 marks]

(d)

M1



Allow planar carbonyl group

M2 Equal chance (50/50) attack from above/below OWTTE

Either side

M3 Giving equal amounts of both optical isomers/enantiomers

[3 marks]

Q3 · June 2023 · Paper 2 · Q4 · [15 marks]

(a) 3-bromopropanenitrile

Allow 3-bromopropane-1-nitrile

[1 mark]

This question is marked using Levels of Response.

(b)

Level 3 5-6 marks	All stages are covered and each stage is generally correct and virtually complete. Answer is communicated coherently and shows a logical progression from Stage 1 to Stages 2 and 3.
Level 2 3-4 marks	All stages are covered but stage(s) may be incomplete or may contain inaccuracies OR two stages are covered and are generally correct and virtually complete. Answer is communicated mainly coherently and shows a logical progression from Stage 1 to Stages 2 and 3.
Level 1 1-2 marks	Two stages are covered but stage(s) may be incomplete or may contain inaccuracies OR only one stage is covered but is generally correct and virtually complete. Answer includes isolated statements but these are not presented in a logical order.
Level 0 0 marks	Insufficient correct chemistry to gain a mark.

Indicative Chemistry content

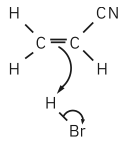
Stage 1 Types of Isomers formed

1a $CH_3CHBrCN$

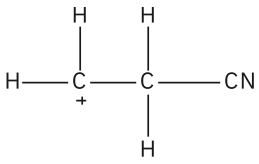
1b Exists as two Optical isomers / enantiomers

Stage 2 Mechanism

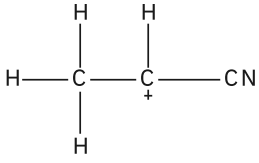
2a 2 curly arrows



2b Intermediate structure primary carbocation OR



2c Alternative Intermediate structure secondary carbocation OR



Stage 3 Optical isomerism

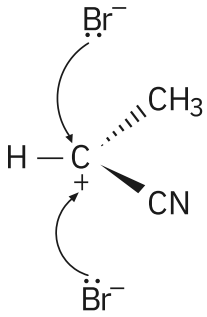
3a 2-bromo isomer has chiral carbon / C with four different groups / non superimposable mirror images

OR



3b Optical because (secondary) C^+ planar

3c So can be attacked from above or below



[6 marks]

(c) M1 KCN or NaCN

Penalise acid in M1

M2 Aqueous AND ethanol (alcohol)

[2 marks]

(d) M1 H_2 and Ni/Pt/Pd

Allow $LiAlH_4$ and (Dry) ether BUT not $NaBH_4$

(ignore heat and pressure)

M2 $NCCH_2CH_2CN + 4H_2 \rightarrow H_2N(CH_2)_4NH_2$

Allow with 8[H]

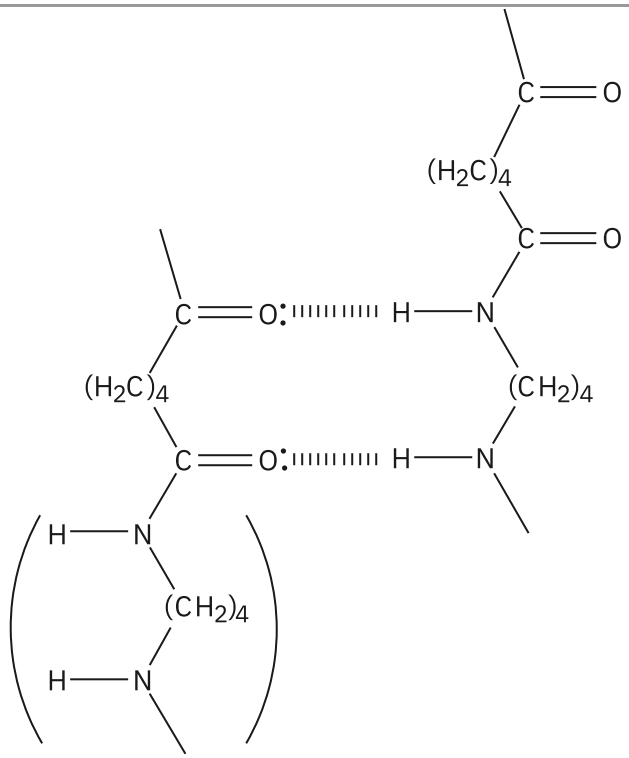
[2 marks]

(e) M1 x = 5

M2 y = 9

[2 marks]

(f)



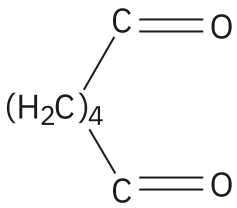
Structure shown on the left of the given structure.

The correct answer is the same irrespective of whether it's drawn on the left or right of the polymer section.

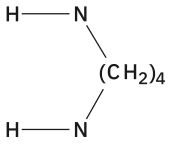
Deduct a mark(s) for error(s)/omission(s)

Must have the following:

- Minimum <u>correct</u> structure

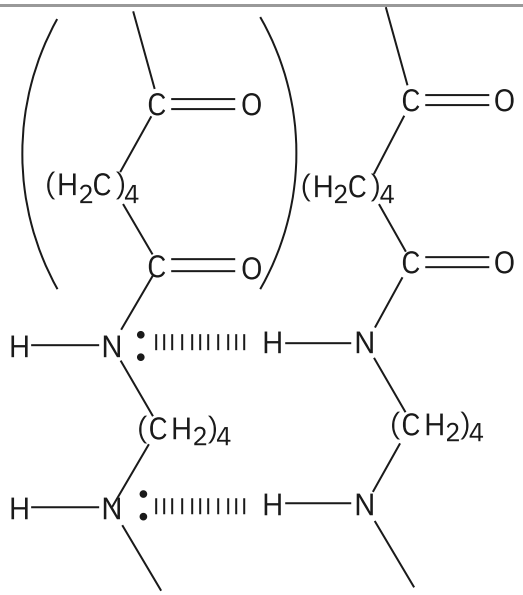


Or



- Lp on O or N
- 2 Linear dashed lines from O or N to H

Allow alternative connection below



[2 marks]

Q4 · June 2019 · Paper 3 · Q21 · [1 mark]

Answer: **A**

Q5 · June 2023 · Paper 3 · Q31 · [1 mark]

Answer: **A**

propene

Q6 · June 2023 · Paper 3 · Q26 · [1 mark]

Answer: **D**

Step 5 H_2 with a nickel catalyst

Q7 · November 2021 · Paper 3 · Q30 · [1 mark]

Answer: **B**

CH_3CH_2CN

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