OCR A-Level Chemistry A

Amines, amino acids and polymers mark scheme · goes with “Amines, amino acids and polymers” · whiteboardchemistry.com/revision/exam-questions/ocr-a-level-chemistry/

Mark schemes

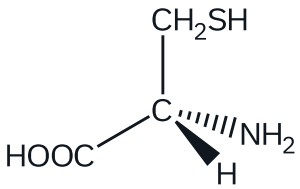
Amines, amino acids and polymers · 11 questions

Q1 · June 2018 · Paper 2 (Synthesis and analytical techniques) · Q17 · [7 marks]

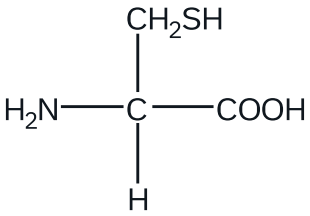
OCR MARK SCHEME

17(a)

Correct groups attached to chiral C of cysteine seen once e.g.

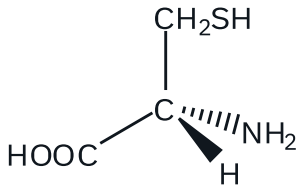


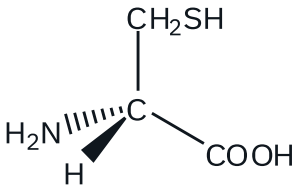
OR



✓

Two 3D structures of cysteine that are mirror images with correct connectivity in both ✓





[2 marks]

EXAMINER GUIDANCE

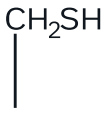
Each structure must have four central bonds with at least two wedges.

For bond into paper accept:

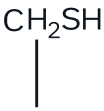


ALLOW *bond to any part of the CH_2 of the CH_2SH group*

e.g. **ALLOW**

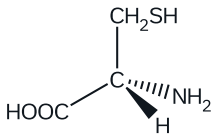


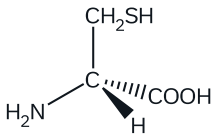
OR



ALLOW *two 3D structures with 2 groups swapped*

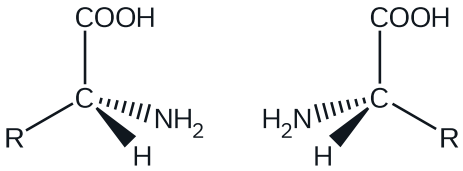
e.g.





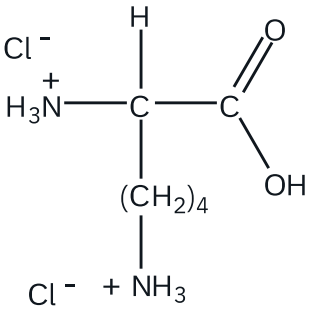
IF *CH_2SH is shown as ‘R’* ***ALLOW*** *1 mark for two 3D structures with correct connectivity that are mirror images*

e.g.



17(b)

Correct salt of lysine with both amine groups protonated



✓✓

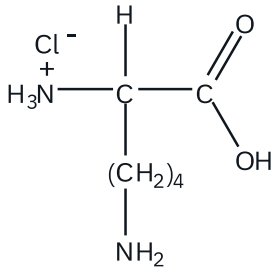
[2 marks]

ALLOW *any combination of skeletal* ***OR*** *structural* ***OR*** *displayed formula as long as unambiguous*

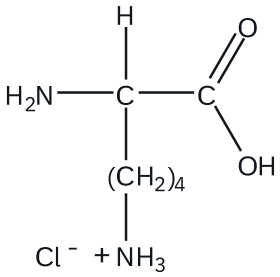
Note: Cl^- is required (question asks for salt)

ALLOW *NH_3Cl i.e charges not required*

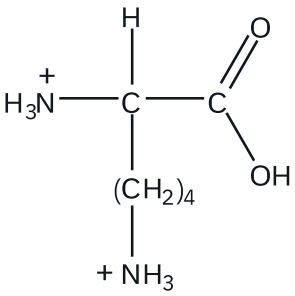
ALLOW *1 mark for*



OR

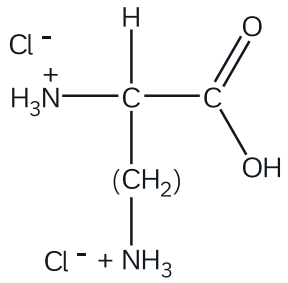


OR



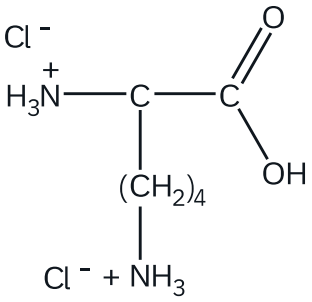
i.e. no Cl^-

IF *there is a small slip in the structure* ***ALLOW 1 mark*** *for diammonium salt e.g*



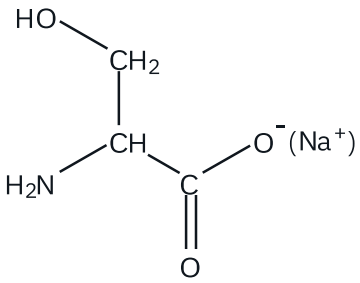
(incorrect number of CH_2 in R group)

OR

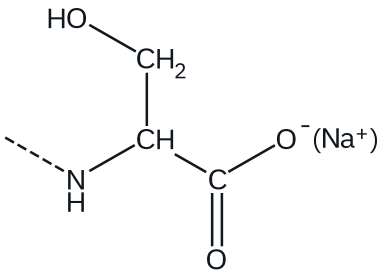


(H missing from α C atom)

17(c)



OR



✓

ALLOW *any combination of skeletal* ***OR*** *structural* ***OR*** *displayed formula as long as unambiguous*

IGNORE *NH_3 (question asks for organic products)*

ALLOW *$–COO^-$* ***OR*** *–COONa*

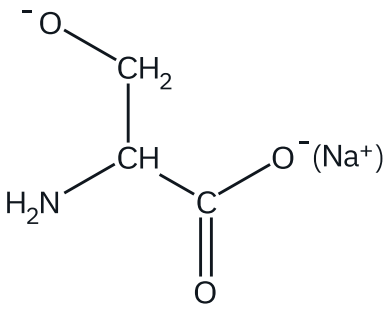
DO NOT ALLOW *negative charge on C atom*

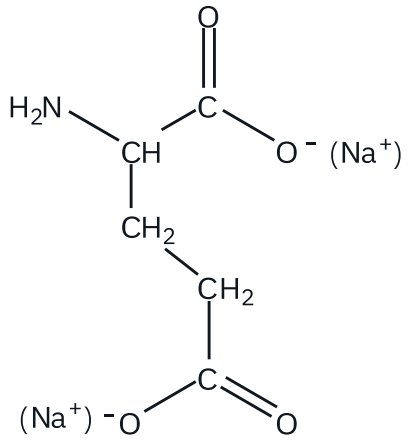
DO NOT ALLOW *–COO–Na (covalent bond)* ***BUT ALLOW ECF*** *if seen in subsequent structures*

DO NOT ALLOW *COOH in this structure*

DO NOT ALLOW *(sodium) salt of alcohol group*

i.e.





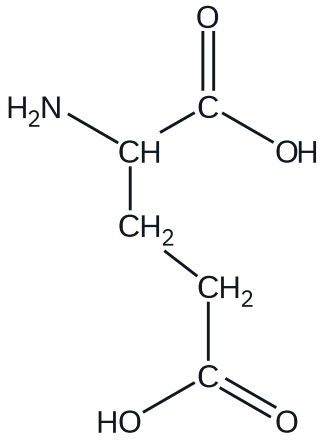
✓✓

i.e. one mark for each group hydrolysed

[3 marks]

ALLOW *COOH groups in this structure*

i.e. award 2 marks for



IGNORE *small slip in carbon chain*

Q2 · June 2019 · Paper 2 (Synthesis and analytical techniques) · Q7 · [1 mark]

Answer: **B**

OCR MARK SCHEME

6

EXAMINER GUIDANCE

ALLOW *6 (This is the number of chiral centres)*

Q3 · June 2022 · Paper 2 (Synthesis and analytical techniques) · Q5 · [1 mark]

Answer: **D**

OCR MARK SCHEME

8

EXAMINER GUIDANCE

ALLOW *8 (correct number of chiral centres)*

Q4 · June 2023 · Paper 2 (Synthesis and analytical techniques) · Q21 · [9 marks]

OCR MARK SCHEME

21(a)

Non-superimposable mirror images (about a chiral centre) ✓

[1 mark]

EXAMINER GUIDANCE

IGNORE *definition of stereoisomers*

21(b)(i)

2-amino-3-methylbutanoic acid

OR

3-methyl-2-aminobutanoic acid ✓

IGNORE *lack of hyphens, extra hyphens, or addition of commas*

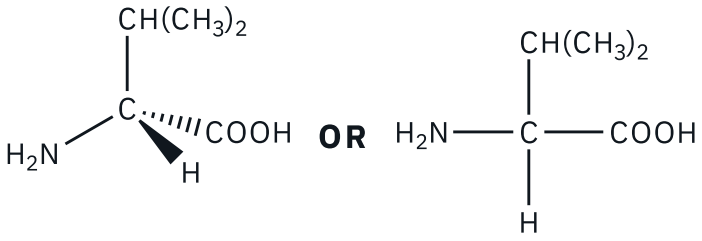
DO NOT ALLOW *the following for methyl: methy, meth, methly*

[1 mark]

DO NOT ALLOW *the following for amino: amine, amin*

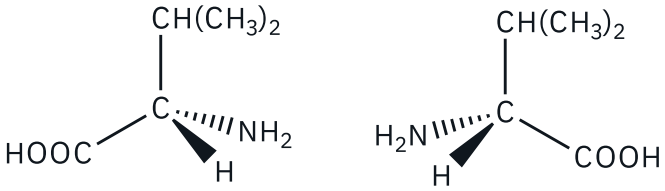
21(b)(ii)

Correct groups attached to chiral C of valine seen once e.g.



✓

Two 3D structures of valine that are mirror images with correct connectivity in both ✓

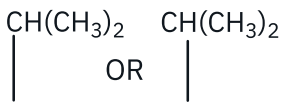


[2 marks]

ALLOW *any combination of skeletal OR structural OR displayed formula as long as unambiguous*

IGNORE *connectivity for the first marking point but must be correct for the second mark.*

ALLOW *bond to any part of the CH of the* $CH(CH_3)_2$ *group e.g.* ***ALLOW***



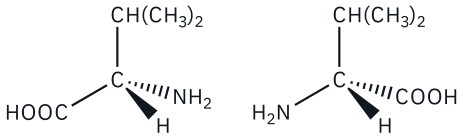
Each structure must have four central bonds with at least two wedges.

For bond into paper accept:



ALLOW *two 3D structures with 2 groups swapped*

e.g.



ALLOW *R or* C_3H_7 *to be shown for* $CH(CH_3)_2$ *for second mark only.*

ALLOW ECF *for second mark for small slips such as missing H e.g.* $C(CH_3)_2$

21(c)(i)

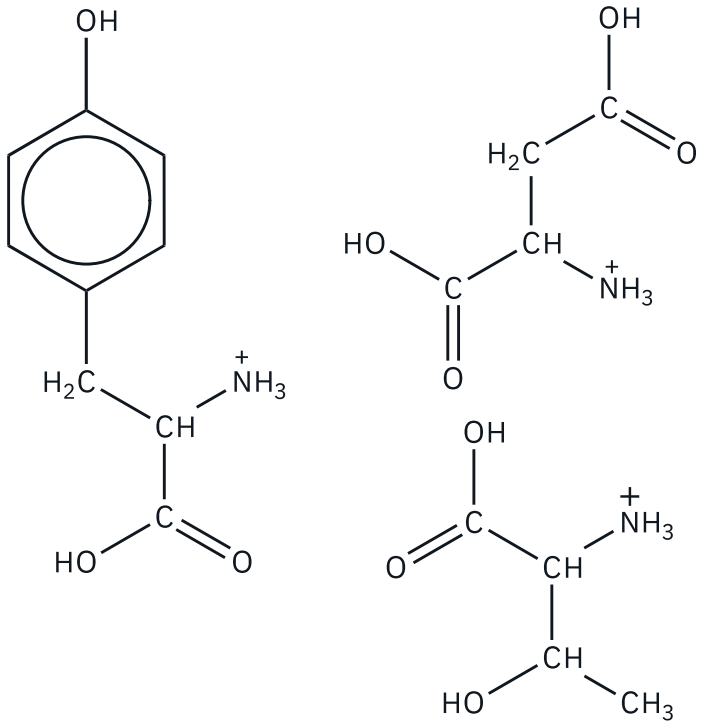
16 ✓

[1 mark]

21(c)(ii)

ALLOW *any combination of skeletal OR structural OR displayed formula as long as unambiguous*

IGNORE *connectivity*



1 mark for each correct structure with

- Either NH_3^+ OR NH_2 ✓✓✓

1 mark for

- all 3 correct structures with NH_3^+ ✓

[4 marks]

ALLOW *+ charge on H of NH_3 group, i.e. NH_3^+*

If structures are shown with NH_3 groups (without the + charge) OR as NH_2^+ groups allow ***ECF*** *for subsequent use.*

ALLOW *structures shown as correctly balanced salts, e.g NH_3Cl OR $NH_3^+Cl^-$ all marks can be awarded.*

Q5 · June 2023 · Paper 3 (Unified chemistry) · Q3 · [6 marks]

OCR MARK SCHEME

3

Level 3 (5–6 marks)

Suggests ALL of the following

- Reagents and conditions for 3 functional groups
- Products for 3 functional groups
- Optical isomerism with description and 3D optical isomers shown

There is a well-developed line of reasoning which is clear and logically structured.

The information presented is relevant and substantiated.

Level 2 (3–4 marks)

Suggests two of the following

- Reagents and conditions for 2 functional groups

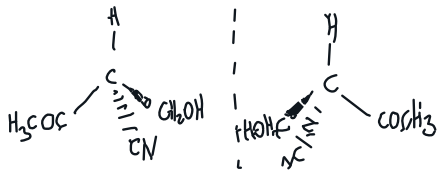
EXAMINER GUIDANCE

CHECK TOP OF QUESTION FOR RESPONSES

Indicative scientific points may include:

Stereoisomerism

- Optical isomerism identified with description: e.g. chiral centre /non-superimposable mirror images
- 3D Optical isomers drawn, e.g.



- Products for 2 functional groups
- Optical isomerism with description OR an attempt to show 3D optical isomers

There is a line of reasoning presented with some structure.

The information presented is relevant and supported by some evidence.

Level 1 (1–2 marks)

Suggests two of the following

- Reagents and conditions for 1 functional group
- Products for 1 functional group
- Identifies optical isomerism with description OR an attempt to show 3D optical isomers

There is an attempt at a logical structure with a line of reasoning.

The information is in the most part relevant.

0 marks No response or no response worthy of credit.

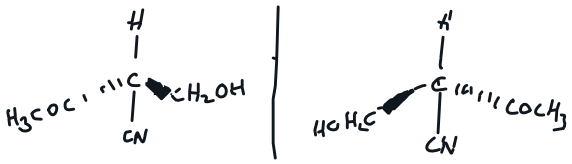
Key points to check

CHECK TOP OF QUESTION for responses

IGNORE CONNECTIVITY

in 3D isomer structures

- IGNORE bond angles
- Wedges needed
- ALLOW



Some responses will not fit into this exact pattern and a best-fit match may be needed

Clear communication

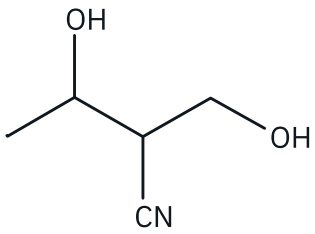
Focus on

- Clear diagrams of 3D optical isomers
- Diagrams of unambiguous structures
- Reagents and functional group formed are linked
- Communication is more a general feel for the quality of the responses.

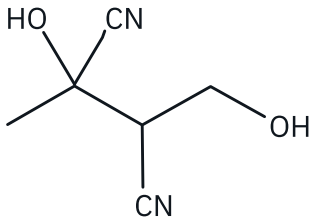
Description is subsumed in 3D diagrams

Reactions of ketone/carbonyl e.g.

$NaBH_4$

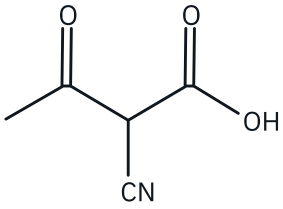


HCN OR CN^-/H^+ (e.g. $NaCN/H^+$)

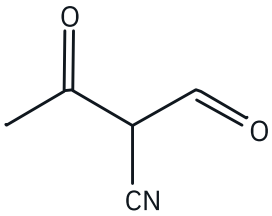


Reactions of –OH, e.g.

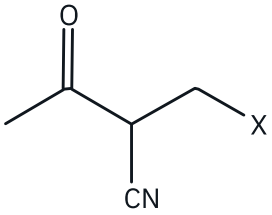
$H^+/Cr_2O_7^{2-}$ OR $H_2SO_4/K_2Cr_2O_7$ reflux



$H^+/Cr_2O_7^{2-}$ OR $H_2SO_4/K_2Cr_2O_7$ distil



$NaBr/KBr/Br^-$ AND acid/H^+ OR HBr



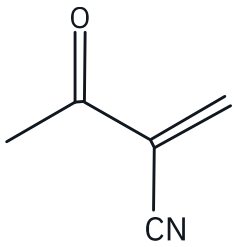
X = halogen

Slips and minor errors in structures

- Do not penalise the odd slip or omission, e.g. An extra C in a chain; a C short in a chain, C shown instead of CH_2 or skeletal
- You need to judge the extent of any slip based on the whole response. Remember that each candidate response is unique.

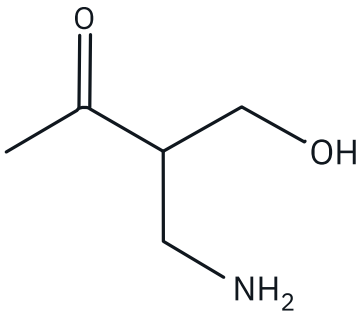
[6 marks]

Acid/H^+ (catalyst) (e.g. H_2SO_4)

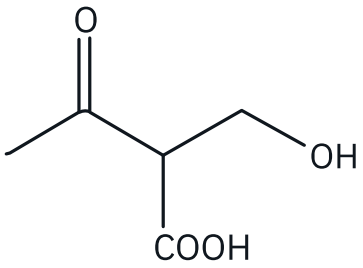


Reactions of C–CN, e.g.

H_2 AND metal catalyst e.g. Ni, Pt, Pd



H^+/H_2O e.g. HCl(aq) or H_2SO_4(aq)



OTHER REAGENTS, CONDITIONS AND PRODUCTS

e.g. $LiAlH_4$ as reagent

Q6 · June 2024 · Paper 2 (Synthesis and analytical techniques) · Q12 · [1 mark]

Answer: **A**

OCR MARK SCHEME

HCl

EXAMINER GUIDANCE

ALLOW HCl

Q7 · June 2024 · Paper 2 (Synthesis and analytical techniques) · Q22 · [6 marks]

OCR MARK SCHEME

22(a)

***IF** answer on answer line = 73518 AWARD 3 marks*

***IF** answer on answer line = 73500 AWARD 2 marks*

EXAMINER GUIDANCE

ALLOW ECF from incorrect M_r of amino acid

Alternative method:

M_r of amino acid = 165 ✓

M_r of 500 molecules = 500 × 165 = 82500 ✓

M_r of polymer = 82500 – (499 × 18) = 73518 ✓

(final answer must be given to nearest whole number)

[3 marks]

M_r of repeat unit = 147 ✓

147 x 500 = 73500 ✓

73500 + 18 = 73518 ✓

Common error for 2 marks

36518 Use of M_r 91

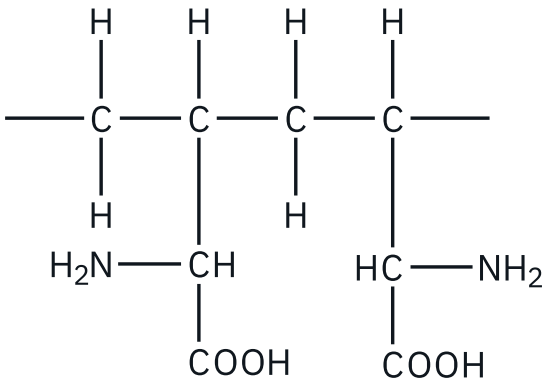
82500 Not shown 165 in working

Common error for 1 mark

45500 Use of M_r 91

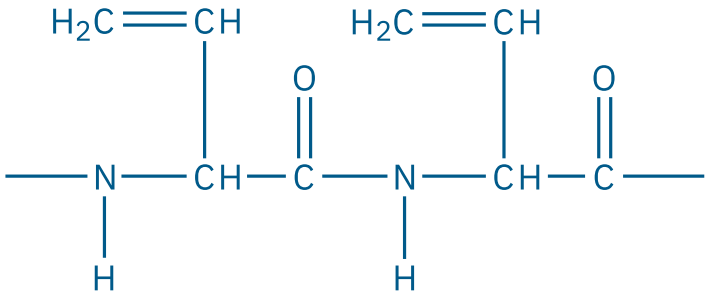
22(b)

Addition polymer



✓

Condensation polymer



Amide link ✓

2 repeat units of correct polymer ✓

[3 marks]

For BOTH structures,

ALLOW *any combination of skeletal* ***OR*** *structural* ***OR*** *displayed formula as long as unambiguous*

'End bonds' MUST be shown (with either a solid or dashed line)

BUT ALLOW ECF **IF** end bonds omitted in both structures

DO NOT ALLOW *more than 2 repeat units*

BUT ALLOW ECF in subsequent structure

IGNORE *connectivity of side groups in both diagrams*

CARE: **ALLOW** any consistent repeat unit: side groups can alternate or be on opposite sides of chain

ALLOW *NH in amide link i.e. without bond shown*

ALLOW *–NH– at either end*

IGNORE *brackets* ***IGNORE*** *n or subscript numbers*

ALLOW *C_2H_3 as side chain for condensation polymer*

ALLOW *1 mark if correct structures given by wrong way round*

Q8 · June 2024 · Paper 2 (Synthesis and analytical techniques) · Q9 · [1 mark]

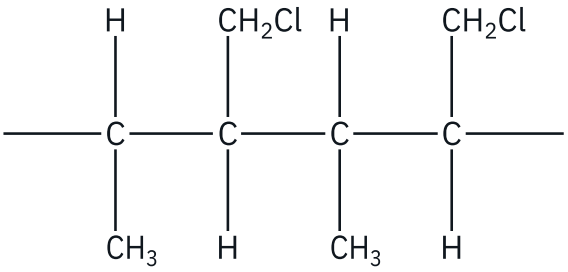
Answer: **C**

Q9 · June 2025 · Paper 2 (Synthesis and analytical techniques) · Q18 · [8 marks]

OCR MARK SCHEME

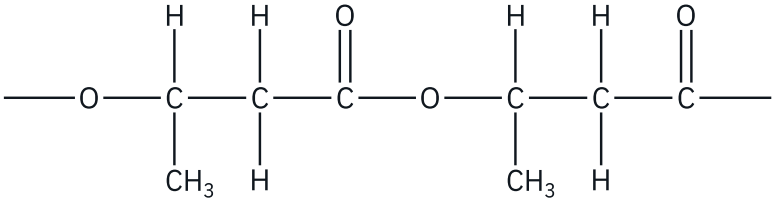
18(a)

Two repeat units of polymer of 1-chlorobut-2-ene



✓

Two repeat units of polymer of 3-hydroxybutanoic acid



Ester link shown ✓

Two complete repeat units ✓

Type of polymerisation

1-chlorobut-2-ene: addition

AND

3-hydroxybutanoic acid: condensation ✓

[4 marks]

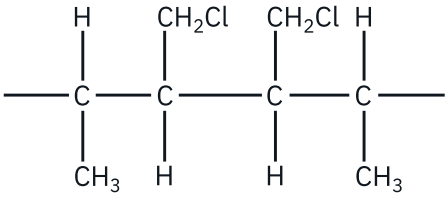
EXAMINER GUIDANCE

ALLOW *any combination of skeletal* ***OR*** *structural* ***OR*** *displayed formula as long as unambiguous*

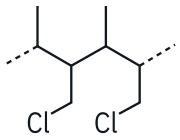
IGNORE *brackets and use of n or subscript numbers*

IGNORE *connectivity*

ALLOW *alternating side chains i.e.*

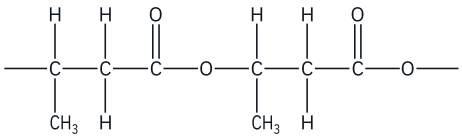


End bonds MUST be shown (solid or dotted) e.g.

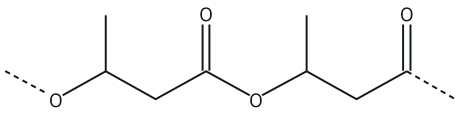


BUT ALLOW ECF IF end bonds omitted in both structures

ALLOW *any whole repeat units e.g.*



End bonds MUST be shown (solid or dotted) e.g.



DO NOT ALLOW *only one repeat unit* ***OR*** *more than 2 repeat units*

BUT ALLOW ECF in subsequent structure

DO NOT ALLOW *'additional'*

18(b)(i)

ALLOW *suitable alternatives for*

(Chlorine containing polymers) produces toxic (products when incinerated) ✓

[1 mark]

'produces' e.g. forms, releases (must be clear that it is a product)

ALLOW *produces HCl /hydrogen chloride/ hydrochloric acid*

ALLOW *'poisonous' for toxic*

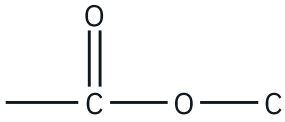
IGNORE *harmful / pollutant / dangerous*

18(b)(ii)

Ester / ester bond / ester group / polyester ✓

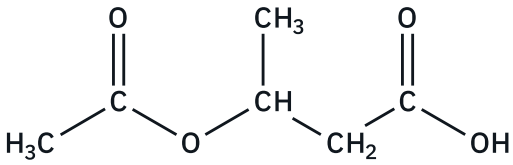
[1 mark]

ALLOW *displayed formula for an ester functional group i.e*

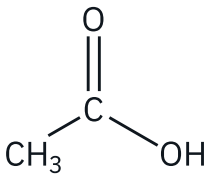


IGNORE *reference to hydrogen bonding*

18(c)



✓



✓

[2 marks]

ALLOW *any combination of skeletal* ***OR*** *structural* ***OR*** *displayed formula as long as unambiguous*

e.g. $CH_3COOCH(CH_3)CH_2COOH$

CH_3COOH

ALLOW *products in either box*

IGNORE *Connectivity* ***BUT DO NOT ALLOW*** *-HO*

Q10 · November 2021 · Paper 2 (Synthesis and analytical techniques) · Q2 · [1 mark]

Answer: **B**

Optical isomerism only.

Q11 · November 2021 · Paper 2 (Synthesis and analytical techniques) · Q9 · [1 mark]

Answer: **C**

$CH_3CH_2Cl \rightarrow CH_3CH_2NH_2$

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