

AQA A-Level Chemistry

Amino acids, proteins & DNA

Questions only

All 15 amino acids, proteins & DNA questions

Questions

15

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	2022 A-level P3 Q33	1	
3	2020 A-level P3 Q30	1	
4	2022 A-level P3 Q32	1	
5	2024 A-level P3 Q33	1	
6	2023 A-level P3 Q36	1	
7	2022 A-level P2 Q4	9	
8	2023 A-level P3 Q35	1	

Q	Source	Marks	Score
9	2021 A-level P3 Q36	1	
10	2021 A-level P3 Q35	1	
11	2022 A-level P3 Q35	1	
12	2019 A-level P3 Q30	1	
13	2025 A-level P2 Q6	5	
14	2025 A-level P3 Q29	1	
15	2025 A-level P3 Q34	1	

Total _____ / 33 Percentage _____ %

Questions from AQA past papers, 2019–2025, reproduced for revision. Practise these topics online, with instant marking:

whiteboardchemistry.com/revision/aqa-a-level-chemistry/exam-questions?topics=amino-acids-proteins-and-dna&len=0

Questions

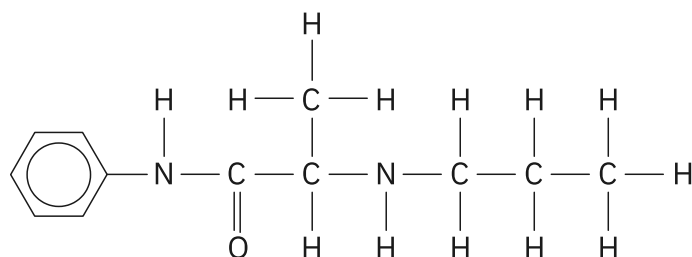
Amino acids, proteins & DNA · 15 questions · 33 marks · time allowed 43 min

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]

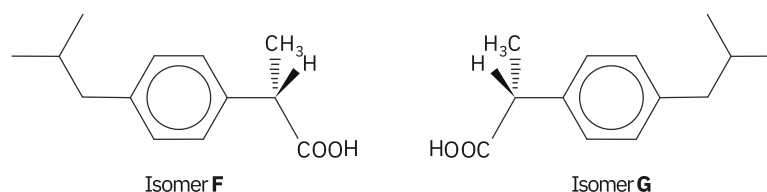
(c) Prilocaine is completely hydrolysed in the human body to give a mixture of products.

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 • June 2022 • Paper 3 • Q33 • [1 mark]

Which statement about $\text{HOCH}_2\text{CH}(\text{NH}_2)\text{COOH}$ is correct?

Tick (✓) one box.

- ☐ **A** It decolourises bromine water.
- ☐ **B** It is a component of DNA.
- ☐ **C** It is insoluble in water.
- ☐ **D** It reacts with hydrochloric acid.

Q3 • November 2020 • Paper 3 • Q30 • [1 mark]

Which structure shows the zwitterion of an amino acid?

Tick (✓) one box.

- ☐ **A**
$$\begin{array}{c} \text{H}_3\text{N}^+ - \text{CH} - \text{COO}^- \\ | \\ \text{H}_2\text{C} - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{NH}_3^+ \end{array}$$

- ☐ **B** $\text{H}_3\text{N}^+ - \text{CH} - \text{COO}^-$
 |
 $\text{H}_2\text{C} - \text{COO}^-$
- ☐ **C** $\text{H}_2\text{N} - \text{CH} - \text{COO}^-$
 |
 $\text{H}_2\text{C} - \text{OH}_2^+$
- ☐ **D** $\text{H}_3\text{N}^+ - \text{CH} - \text{COO}^-$
 |
 $\text{H}_2\text{C} - \text{SH}$

Q4 • June 2022 • Paper 3 • Q32 • [1 mark]

Which type of interaction between polypeptide chains is mainly responsible for maintaining the secondary structure of a protein in the form of an alpha helix?

Tick (✓) one box.

- ☐ **A** covalent bonds
- ☐ **B** hydrogen bonds
- ☐ **C** ionic interactions
- ☐ **D** van der Waals forces

Q5 • June 2024 • Paper 3 • Q33 • [1 mark]

Which structure shows a zwitterion of an amino acid?

Tick (✓) one box.

- ☐ **A** $\text{H}_3\text{N}^+ - \text{CH} - \text{COO}^-$
 |
 $\text{H}_2\text{C} - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{NH}_3^+$
- ☐ **B** $\text{H}_3\text{N}^+ - \text{CH} - \text{COO}^-$
 |
 $\text{H}_2\text{C} - \text{COO}^-$
- ☐ **C** $\text{H}_2\text{N} - \text{CH} - \text{COO}^-$
 |
 $\text{H}_2\text{C} - \text{OH}$
- ☐ **D** $\text{H}_3\text{N}^+ - \text{CH} - \text{COO}^-$
 |
 $\text{H}_2\text{C} - \text{SH}$

Q6 • June 2023 • Paper 3 • Q36 • [1 mark]

Cisplatin has the formula $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$ Cisplatin is an anti-cancer drug that prevents replication of DNA. When cisplatin bonds to DNA, which is the correct ligand replacement reaction?

Tick (✓) one box.

- ☐ **A** replacement of one NH_3 ligand
- ☐ **B** replacement of two NH_3 ligands
- ☐ **C** replacement of one NH_3 ligand and one Cl^- ligand
- ☐ **D** replacement of two Cl^- ligands

Q7 • June 2022 • Paper 2 • Q4 • [9 marks]

Proteins are polymers made from amino acids.

Part of the structure of a protein is shown.

–Cys–Ser–Asp–Phe–

Each amino acid in the protein is shown using the first three letters of its name.

(a) Identify the type of protein structure shown.

Tick (✓) one box.

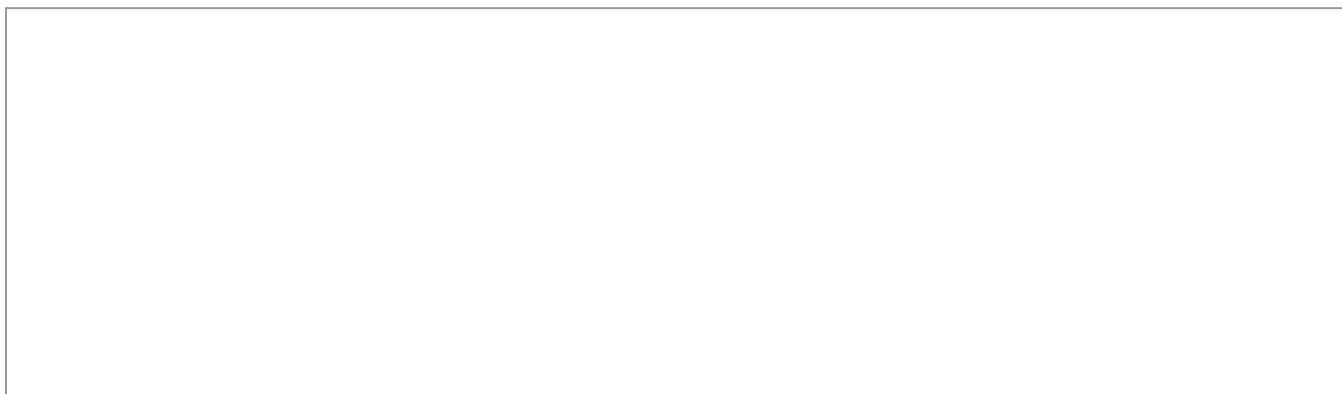
Primary	☐
Secondary	☐
Tertiary	☐

[1 mark]

(b) Draw a structure for the –Cys–Ser– section of the protein.

Use the Data Booklet to help you answer this question.

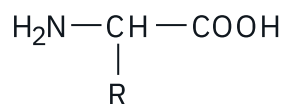
[2 marks]



(c) Name the other substance formed when two amino acids react together to form part of a protein chain.

[1 mark]

The general structure of an amino acid is shown.



R represents a group that varies between different amino acids.

R groups can interact and contribute to protein structure.

(d) Explain why the strength of the interaction between two cysteine R groups differs from the strength of the interaction between a serine R group and an aspartic acid R group.

Use the Data Booklet to help you answer this question.

[4 marks]

(e) Deduce the type of interaction that occurs between a lysine R group and an aspartic acid R group.

[1 mark]

Q8 • June 2023 • Paper 3 • Q35 • [1 mark]

Which statement about enzymes is not correct?

Tick (✓) one box.

- ☐ **A** The tertiary structure of an enzyme influences which molecules can bind to the active site.
- ☐ **B** The action of enzymes can be inhibited by a molecule or ion that binds to the active site.
- ☐ **C** Enzymes work equally well on both optical isomers of a substrate.
- ☐ **D** Computers can be used to design drugs to block active sites on enzymes.

Q9 • November 2021 • Paper 3 • Q36 • [1 mark]

Which row shows a pair of bases that can link two strands of DNA with three hydrogen bonds? Use the Data Booklet to help you answer this question. Base 1 Base 2

Tick (✓) one box.

- ☐ **A** adenine guanine
- ☐ **B** cytosine thymine
- ☐ **C** cytosine guanine
- ☐ **D** adenine thymine

Q10 • November 2021 • Paper 3 • Q35 • [1 mark]

Which is the structure of a zwitterion of an amino acid?

Tick (✓) one box.

- ☐ **A**
$$\begin{array}{c} \text{H}_3\text{N}^+ - \text{CH} - \text{COO}^- \\ | \\ \text{H}_2\text{C} - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{NH}_3^+ \end{array}$$
- ☐ **B**
$$\begin{array}{c} \text{H}_3\text{N}^+ - \text{CH} - \text{COO}^- \\ | \\ \text{H}_2\text{C} - \text{COO}^- \end{array}$$
- ☐ **C**
$$\begin{array}{c} \text{H}_2\text{N} - \text{CH} - \text{COO}^- \\ | \\ \text{H}_2\text{C} - \text{OH}_2^+ \end{array}$$
- ☐ **D**
$$\begin{array}{c} \text{H}_3\text{N}^+ - \text{CH} - \text{COO}^- \\ | \\ \text{H}_2\text{C} - \text{SH} \end{array}$$

Q11 · June 2022 · Paper 3 · Q35 · [1 mark]

Which compound is not a 2-aminocarboxylic acid?

Tick (✓) one box.

- ☐ **A** $\text{CH}_3\text{CH}(\text{NH}_2)\text{COOH}$
- ☐ **B** $\text{CH}_3\text{CH}(\text{NH}_2)\text{CH}_2\text{COOH}$
- ☐ **C** $\text{CH}_3\text{CH}_2\text{CH}(\text{NH}_2)\text{COOH}$
- ☐ **D** $(\text{CH}_3)_2\text{CHCH}(\text{NH}_2)\text{COOH}$

Q12 · June 2019 · Paper 3 · Q30 · [1 mark]

Two strands of DNA are linked together by hydrogen bonding between bases on each strand.

Which row shows the number of hydrogen bonds between the pair of bases?

Use the Data Booklet to help you answer this question.

Number of

Base 1 Base 2 hydrogen bonds

Tick (✓) one box.

- ☐ **A** Base 1: adenine · Base 2: guanine · Number of hydrogen bonds: 2
- ☐ **B** Base 1: cytosine · Base 2: thymine · Number of hydrogen bonds: 2
- ☐ **C** Base 1: guanine · Base 2: cytosine · Number of hydrogen bonds: 3
- ☐ **D** Base 1: adenine · Base 2: thymine · Number of hydrogen bonds: 3

Q13 · June 2025 · Paper 2 · Q6 · [5 marks]

This question also needs NMR.

GHK is a natural tripeptide found in human blood plasma.

The amino acid sequence of GHK is Lys-His-Gly

Each amino acid is represented by a three-letter abbreviation.

Lys = lysine His = histidine Gly = glycine

Glycine has the structure $\text{H}_2\text{NCH}_2\text{COOH}$

06.1 D_2O is used as the solvent when obtaining a ^1H NMR spectrum for lysine.

Give one reason why D_2O is used rather than CCl_4 and one reason why D_2O is used rather than water.

[2 marks]

D_2O rather than CCl_4

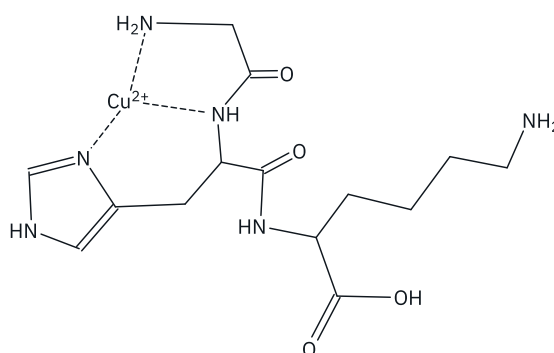
D_2O rather than water

GHK is commonly used in cosmetics as part of anti-ageing treatments.

GHK binds to copper(II) ions in the body to form GHK–Cu

Figure 6 shows the structure of GHK–Cu

Figure 6



06.2 Use Figure 6 to determine the structure of the amino acid histidine, His

Lysine molecules can polymerise to give poly(lysine).

[1 mark]

06.3 Increasing the temperature of an alkaline solution of poly(lysine) changes the type of



secondary structure in poly(lysine), as shown.

Name the type of secondary structure before and after heating.

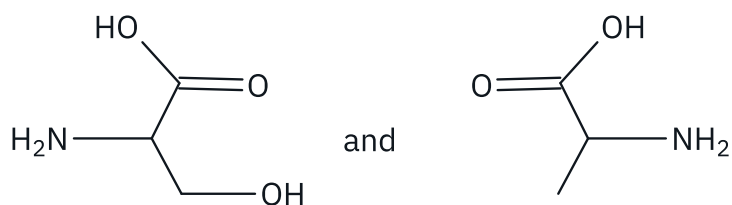
[2 marks]

Type of secondary structure before heating

Type of secondary structure after heating

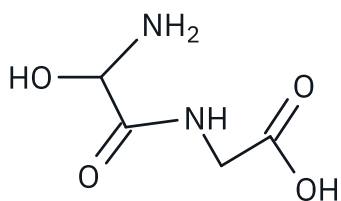
Q14 • June 2025 • Paper 3 • Q29 • [1 mark]

What is the structure of a dipeptide formed from the two amino acids shown?

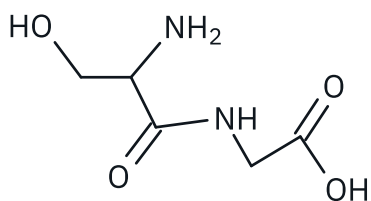


Tick (✓) one box.

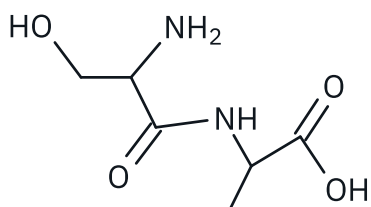
☐ **A**



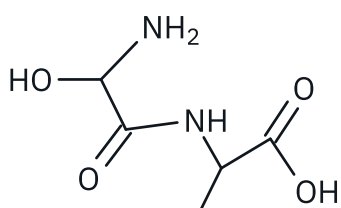
☐ **B**



☐ **C**



☐ **D**



Q15 · June 2025 · Paper 3 · Q34 · [1 mark]

Which statement about enzymes is correct?

Tick (✓) one box.

- ☐ **A** Enzymes are a type of nucleotide.
- ☐ **B** Enzymes are polymers.
- ☐ **C** Enzymes are not affected by changes of pH.
- ☐ **D** Enzymes act as catalysts by increasing activation energy.

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Mark scheme:

whiteboardchemistry.com/revision/aqa-a-level-chemistry/exam-questions/pdf/amino-acids-proteins-and-dna-mark-scheme.pdf