Name	Date started	Target end date

GCE AS / A LEVEL — BIOLOGY UNIT 1 QUESTION PACK

1071-01 (Legacy BY1) · New spec Unit 1 Topic 2 · AS unit, first sat 2016, 80 marks, 1h 30min paper

REVISE
.wales

BIOLOGY — UNIT 1 · LIPIDS & PROTEINS

BY1.1 Biological compounds — lipids, amino acids and the four levels of protein structure

Triglycerides and phospholipids, amino acid structure and the peptide bond, plus primary / secondary / tertiary / quaternary protein structure (including haemoglobin and the Biuret test).

LEGACY 2008 SPECIFICATION

Estimated time for entire question pack: ~40 min

Derived from the legacy BY1 paper's pace of ~1.1 min/mark, padded for long-prose answers (25 marks over 3 questions).

*You are advised to **not** attempt to complete all of this in one sitting.*

ABOUT THIS QUESTION PACK

This is a **comprehensive practice question pack**, not a single mock paper. It contains every question from the legacy WJEC BY1 papers (2008 modular spec, 2011–2017) that maps onto new-spec AS Unit 1 Topic 2 (1.1).

Questions are ordered by source paper date.

INSTRUCTIONS

Use black ink or black ball-point pen. Show all working — quality of written communication will affect marks. A calculator is allowed. Diagrams included in answers must be fully annotated.

For Examiner's use only

Q	Source	Max	Mark
1	Jun 13 Q1	8	
2	Jun 14 Q3	6	

Q	Source	Max	Mark
3	Jun 17 Q1	11	
Total		**25**	

Lipids & Proteins — what the new spec asks

WJEC GCE AS / A Level Biology (from 2015) · Unit 1: Basic Biochemistry & Cell Organisation · Topic 1.1.

Lipids

- Triglyceride = glycerol + 3 fatty acids via ester bonds (condensation).
- Saturated (no C=C) vs unsaturated (one or more C=C).
- Phospholipid = glycerol + 2 fatty acids + phosphate; amphipathic.
- Roles: energy store, insulation, membranes, hormones.

Amino acids

- General structure: amino group, carboxyl group, R-side chain.
- 20 standard amino acids; differ only in R group.
- Peptide bond formed by condensation between NH_2 and COOH.

Protein structure

- Primary: amino acid sequence.
- Secondary: α-helix or β-pleated sheet (H-bonds).
- Tertiary: 3D fold (ionic / H / disulfide / hydrophobic interactions).
- Quaternary: ≥2 polypeptide chains (e.g. haemoglobin = 4 subunits).

Biochemical tests

- Biuret: protein gives purple/violet with NaOH + dilute $CuSO_4$.
- Emulsion test: lipid + ethanol then water gives cloudy emulsion.
- Globular (haemoglobin, enzymes) vs fibrous (collagen, keratin).

Crib sheet »

Lipids & Proteins in one page

Quick-reference notes — revisit before each question.

Triglycerides

Glycerol + 3 fatty acids by 3 condensations (3 H_2O lost).

Ester bonds; hydrophobic; energy store (37 kJ g^{-1}).

Saturated: no C=C; solid at room temp (butter, lard).

Phospholipids

Glycerol + 2 fatty acids + phosphate group.

Polar head (hydrophilic) + non-polar tails (hydrophobic).

Self-assemble into bilayers ⇒ cell membranes.

Amino acids

$H_2N–CH(R)–COOH$.

Peptide bond by condensation between $–NH_2$ and –COOH.

Dipeptide + H_2O on hydrolysis.

Protein levels

1° sequence → 2° (α-helix / β-sheet H-bonds) → 3° (3D fold) → 4° (subunits).

Stabilised by H, ionic, disulfide, hydrophobic interactions.

Denaturation: high T or extreme pH breaks bonds.

Globular vs fibrous

Globular: soluble, regulatory / enzymatic (haemoglobin, insulin).

Fibrous: insoluble, structural (collagen, keratin).

Haemoglobin: 4 subunits + 4 haem (Fe^{2+}).

Biuret test

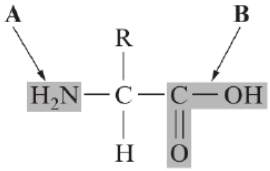
Sample + NaOH + dilute $CuSO_4$.

Purple/violet = peptide bonds present.

Quantitative: colorimeter at ~540 nm.

Examiner only

1. *(a)* The diagram below shows the structure of an amino acid.



(i) Name the two shaded groups **A** and **B** shown on the diagram above. [2]

A .....

B .....

(ii) What is represented by letter R in the diagram above? [1]

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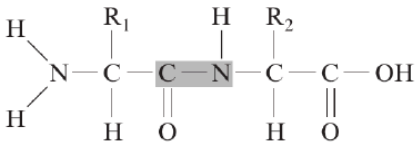
(b) The diagram below shows two amino acids joined together.



Using the diagram shown above:

(i) Name the type of molecule shown. [1]

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(ii) Name the bond highlighted in diagram *(b)* above. [1]

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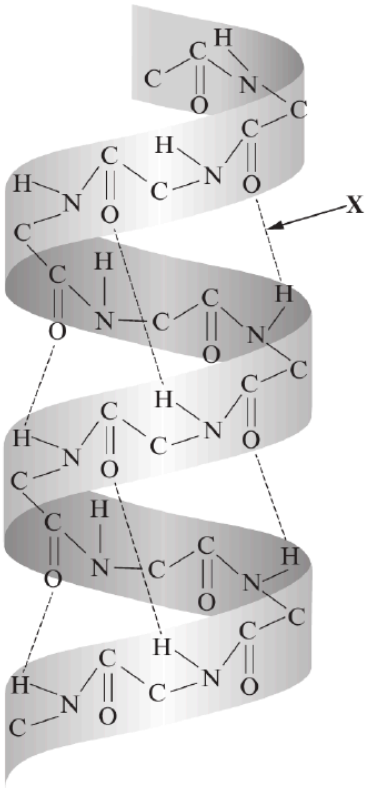
Examiner only

(c) The diagram below shows part of a protein molecule.



(i) Name bond **X** shown on the diagram above. [1]

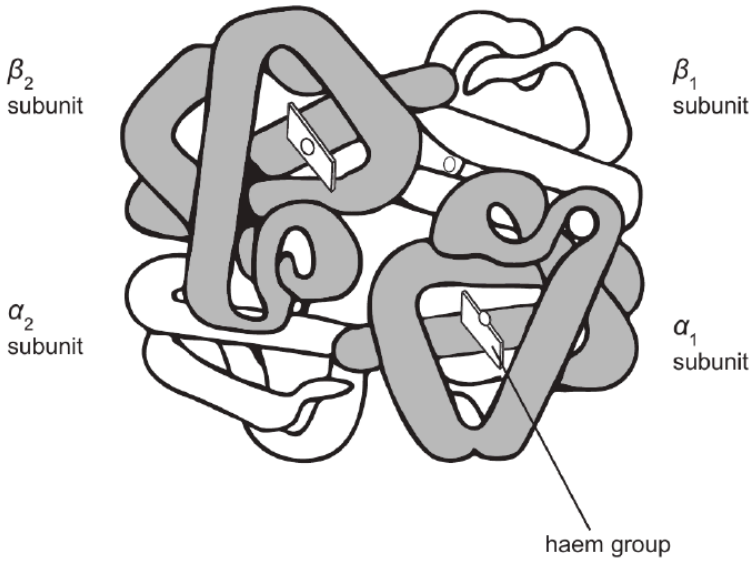
(ii) What name is given to the shape of this molecule? [1]

(iii) What level of protein structure does the diagram above show? [1]

(Total 8 marks)

Examiner only

3. The diagram below shows a molecule of haemoglobin.



(a) State the inorganic ion present in the haem group. [1]

(b) Using the diagram above, explain why this molecule is regarded as having a quaternary structure. [2]

Examiner only

(c) Describe the biochemical test that could be performed to test for a protein. [2]

(d) Suggest how the concentration of a specific protein could be measured in a sample of urine. [1]

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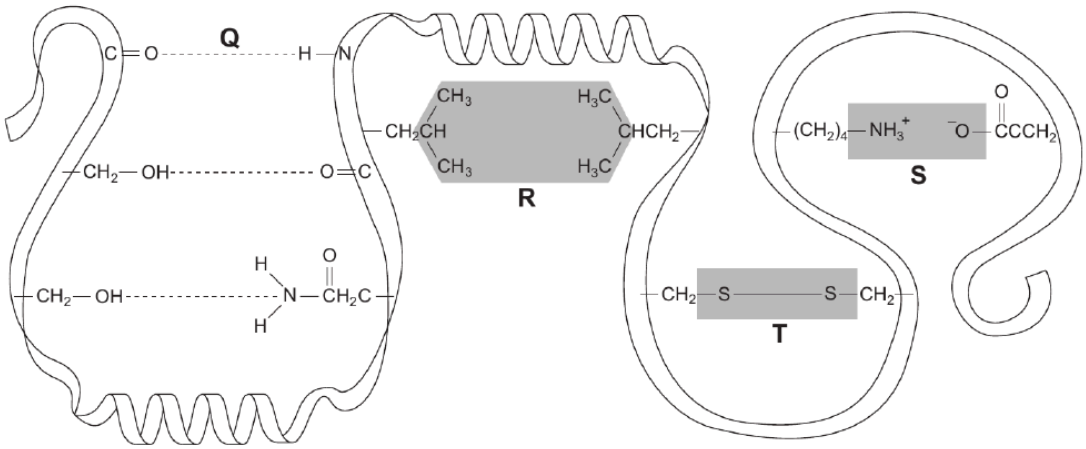
Examiner only

Answer **all** *questions.*

1. The diagram below shows the structure of a protein. The bold letters indicate the different types of bond found in a protein.



(a) (i) Name each type of bond labelled on the diagram. [4]

Q .....

R .....

S .....

T .....

(ii) Explain how the primary structure of a polypeptide is formed. [2]

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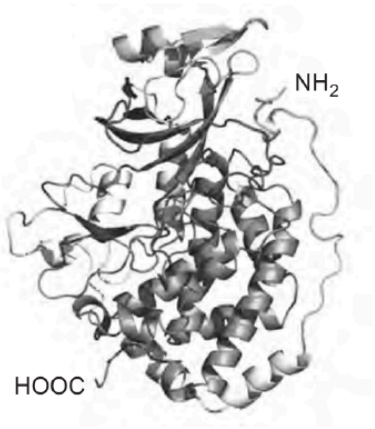
Examiner only

(b) Milk contains many different proteins which are important for the growth and development of infants.
A ribbon diagram of one of these proteins is shown below.

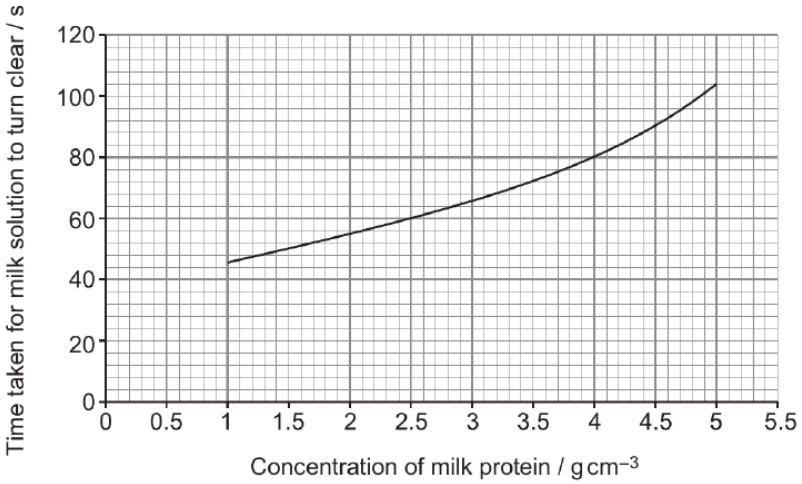


(i) What is the highest level of structure found in this protein? Explain your answer. [2]

4

An enzyme Neutrase™ can be used to digest milk proteins. The milk solution will turn clear as the protein is broken down. The time taken for the milk solution to turn clear can be used to determine the protein content of the milk sample.

A standard curve for the digestion of milk protein using Neutrase™ is shown below.



Data provided to a student, showing the concentration of protein in milk produced by different species of mammal, are given below.

Mammal	Concentration of milk protein / g cm^{-3}	Time for infant mammal to double its mass / days
Human	1.2	180
Horse	2.4	60
Cow	3.3	47
Goat	4.1	19
Dog	7.1	8
Cat	9.5	7
Rat	11.8	5

Examiner only

(ii) Two unknown samples of milk were given to the student to test. Sample **X** took 48 seconds to turn clear, sample **Y** took 82 seconds. Determine the mammal from which each of these samples was taken. [1]

X .....

Y .....

(iii) Describe the relationship shown by the data in the table and suggest an advantage to a mammal of producing milk with a greater protein content. [2]

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END OF QUESTION PACK

3 questions · 25 marks · ~40 min
Source: WJEC BY1 (2008 modular spec, 2011–2017)
Curated for WJEC Biology 2015 spec AS Unit 1 — Topic 2 (1.1)